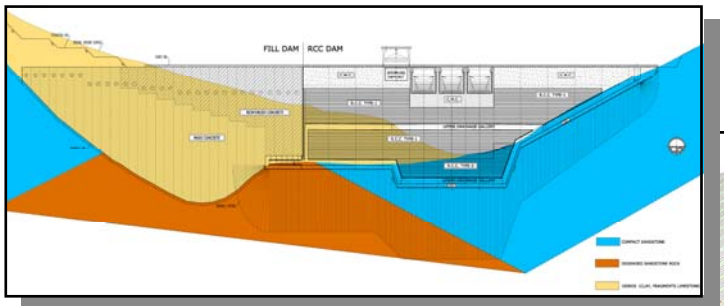
DAMS

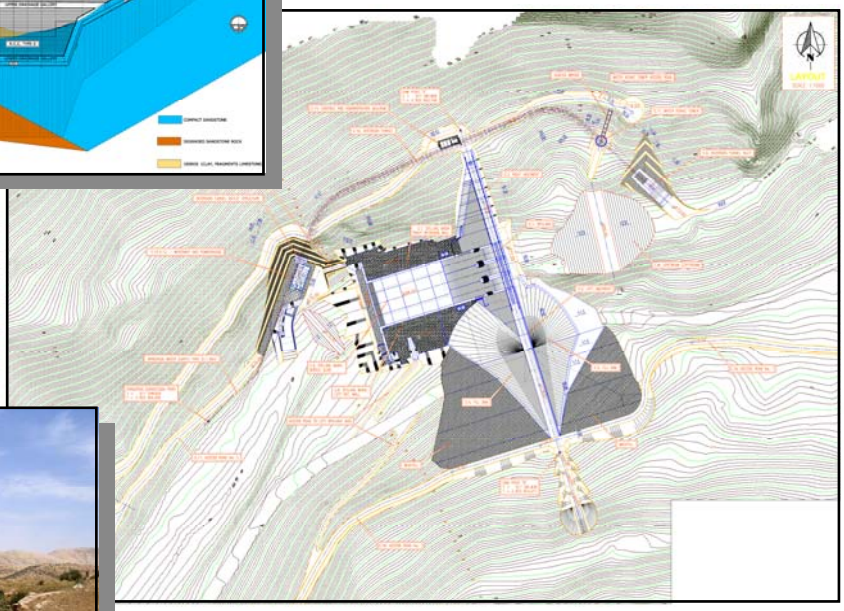
HPP

WTP

PROFESSIONAL EXPERIENCE

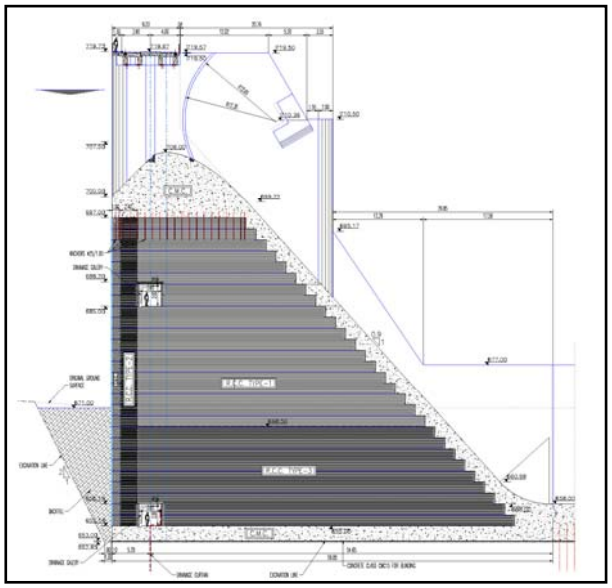
BASSARA DAM and IRRIGATION PROJECT

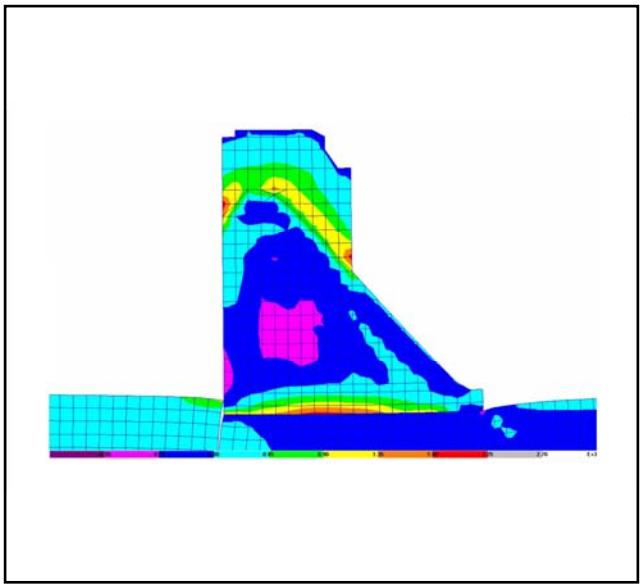




Contract title:	**PRELIMINARY & PLANNING REPORT WITH INVESTIGATION WORKS, FINAL DESIGN & TENDER DOCUMENTS FOR BASSARA DAM**
Location/River:	Bassara gorge / Tawooq Chai River IRAQ
Employer:	Ministry of Water Resources IRAQ
Commencement date:	2005.
Completion date:	2007.
Contract price:	2,305,000. USD
Investment cost:	110,600,000. USD

Hydrology data	
Catchment area	574 km^2
Average discharge	8 m^3/s
PMF flood	2870 m^3/s
Dam	
Type	RCC & Fill dam with central diaphragm
Height	67.0 m
Crest length	284.7 m
Concrete vol.	0.26 x 10^6 m^3
Embankment vol.	0.26 x 10^6 m^3
Reservoir total storage	54 x 10^6 m^3
Spillway	
Type	Gated (radial gates) / 3 bays
HPP	
Installed capacity	4.8 MW (2 units)
Turbine type	Fransis
Tunnels (diversion, bottom outlet, HPP & irrigation intake	
Diameter	8.50 m
Total length	430 m
Irrigation area	2900 ha





Description of the Project:

Location of designed Bassara Dam is on river Tawooq Chai, some 20 km far from Sulaimanyah town in Iraq. The main purpose of 54 milions m^3 large Bassara reservoir is to enable regulation of Tawooq Chai for irrigation of 2900 ha of cultivated land. Beside this, construction of the dam will improve river low flows regime. The water head difference which will be formed with the dam will be used for electric power production, so the HPP of 4.8 MW is proposed. Bassara dam is designed as a combination of RCC Dam with Spillway & Fill Dam with central concrete diaphragm. Appurtenant structures includes diversion tunnel, water intake tower, bottom outlet with penstock & irrigation pipe and HPP.

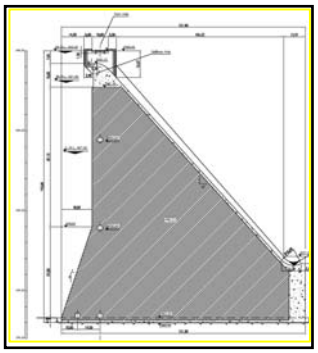
Location of the Irrigation field is some 11 km downstream of the dam location. Water from the Bassara reservoir to the irrigation field is conveyed through a 1400 mm main pipe. For further water distribution a network of primary and secondary level pipes is designed. The total length of all pipes in the network including the main pipeline is approx. 90 km.

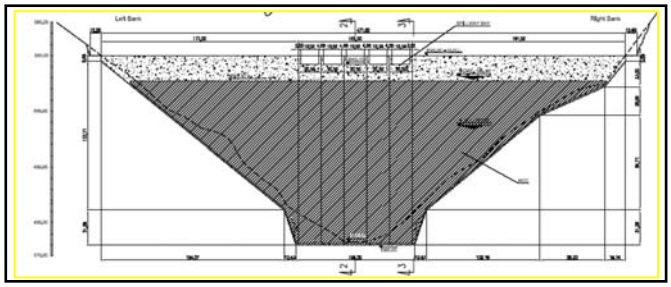
The Services Provided:

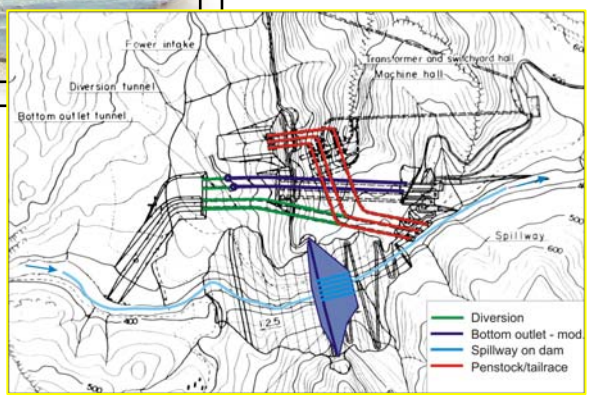
Performance of Topographical & Geological Investigation Works and Preparation of Preliminary & Planning Report, Final Design & Tender Documents have been the most essential goals of the Project, including the following specific Consulting Services:

- Preparation on Investigation Works Program & Performance of Investigation Works;
- Determination of General Layout, Optimization and Engineering Design of the Dam, Appurtenant Structures & HPP at Preliminary with Planning Report & Final Design stage;
- Preparation of Hydrological, Topographical & Geological Study at Preliminary & Planning Report stage;
- Implementation of Earthquake Hazard Study at Planning Report stage;
- Preparation of Environmental Impact Assessment Study at Preliminary & Planning Report stage;
- Implementation of Cost Estimate with Construction Time Schedule at Preliminary with Planning Report & Final Design stage;
- Preparation of Economic & Financial Analysis at Preliminary & Planning Report stage;
- Establishment of Tendering Procedure and Rendering Assistance to Client during Tendering Procedure.

ALTERNATIVES WITH REDUCING BEKHME DAM HEIGHTS

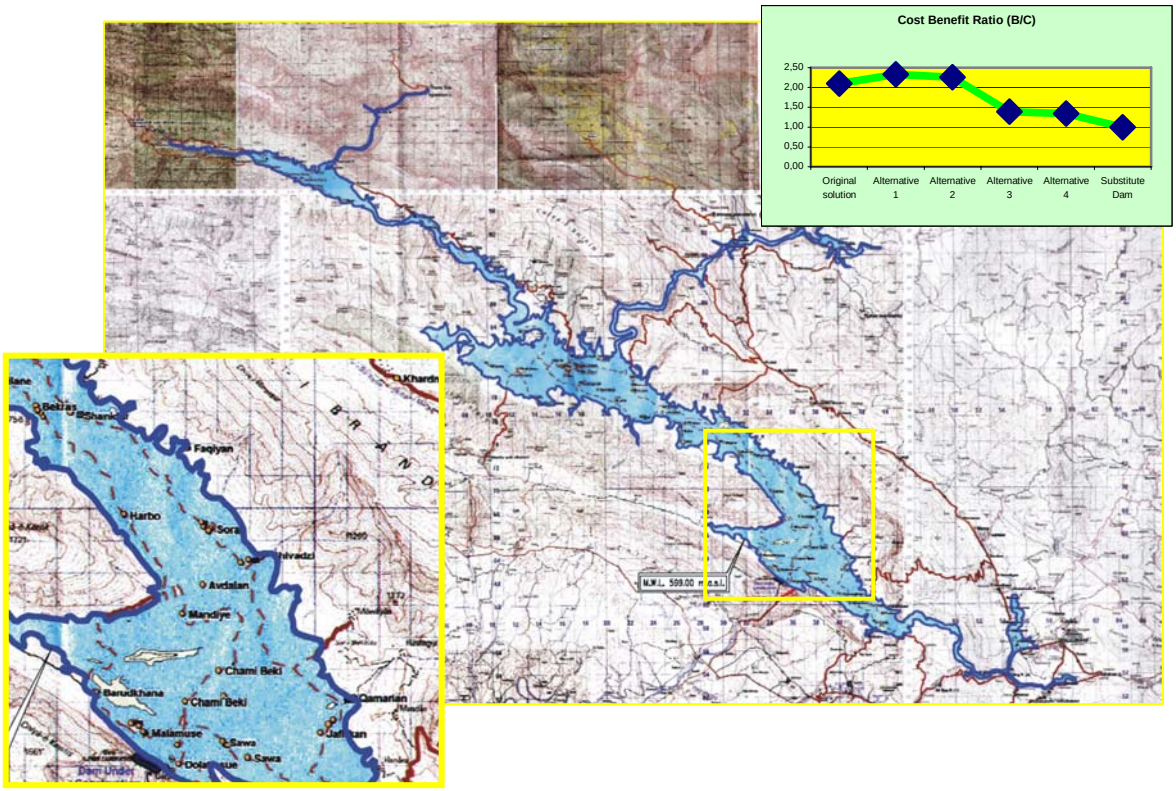






Contract title:	**PRE-FEASIBILITY STUDY OF THE ALTERNATIVES WITH REDUCING BEKHME DAM HEIGHTS**
Location/River:	Bekhme gorge / Greater Zab River IRAQ
Employer:	Ministry of Water Resources IRAQ
Commencement date:	2006.
Completion date:	2007.
Contract price:	400,000 USD
Investments cost (including irrigation):	3,510,000,000 USD

Hydrology data	
Catchment area	166000 km^2
Average discharge	377 m^3/s
PMF flood	25 850 m^3/s
Dam-Alternative 1	
Type	RCC dam
Height	170 m
Crest length	471 m
Concrete vol.	2.6 x 10^6 m^3
Reservoir total storage	8110 x 10^6 m^3
Spillway	
Type	Ungated / 5 bays
HPP	
Installed capacity	840 MW (6 units)
Turbine type	Fransis



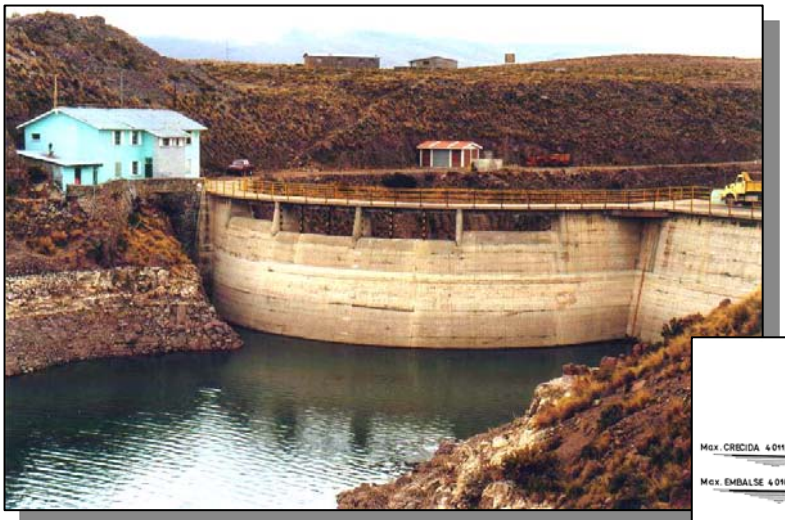
Description of the Project: The commencement of Bekhme Dam Project construction, based on original EPDC (Japan) project started in 1986. The works were suspended in 1990. Since than, a lot of villages have been founded in the area envisaged for the impoundment, so resettlement of the villagers became a serious issue. Due to that reason, an analysis of alternatives with reduced dam heights was performed.

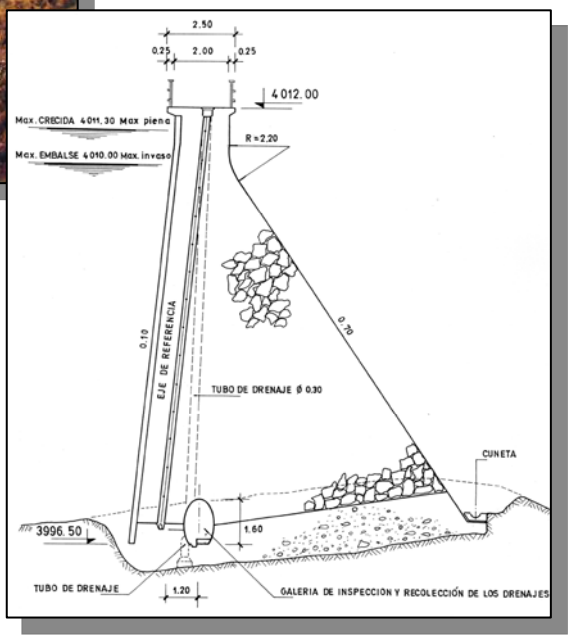
A pre-feasibility study of four alternative technical solutions was done. Two dam types – RCC and fill dam type – as well as two maximum impoundment levels (reduction from 599 m a.s.l. to 550 m a.s.l. and to 517 m a.s.l.) were analyzed. Proposed technical solutions incorporated more than 90 % of already executed constructions at the dam site. For each alternative, construction costs and resettlement costs were estimated as well as reduced effects of irrigation and power production. A thorough economical analysis was preformed. Characteristic parameters B-C (Net Present Value), B/C, EIRR (Economic internal rate of return) and LRIC (Long Run Incremental Costs) were evaluated for alternatives and compared with parameters for original solution. An optimal alternative (RCC, 550 m a.s.l.) was recommended.

The Services Provided:

- Review of existed documents and data and their systematisation ;
- Determination of general layout, optimization and engineering design of the Dam, Appurtenant Structures & HPP for each alternative;
- Engineering calculations;
- Estimation of total cost for each alternative;
- Analyses and evaluation of potential irrigation and power production effects for each alternative;
- Estimation of reduction of resettlement costs as well as preparation of list of impoundment villages for each alternative;
- Evaluation of characteristic economic parameters and recommendation of optimal alternative.

EL FRAYLE DAM PROJECT





Location:	The Chili River, Peru
Employer:	INADE-Autodema-Peru
Commencement date:	1954. (2000. sanation)
Completion date:	1958.
Contract price:	$ 800 000
Services provided:	▪ Study for the sanation ▪ Final Design for the additional works

<u>Dam I:</u>

Type:	Arch dam
Height:	74.0 m
Rockfill/conc/vol:	8 000 m^3
Reservoir capacity:	

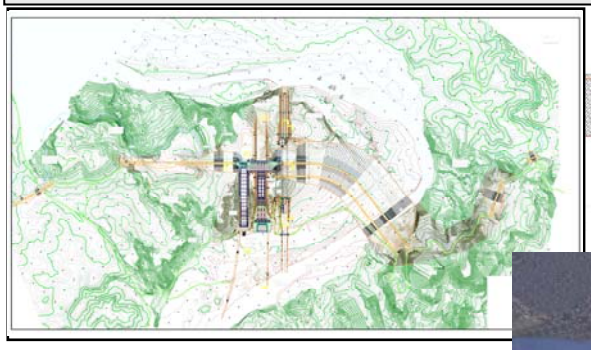
<u>Dam II</u>

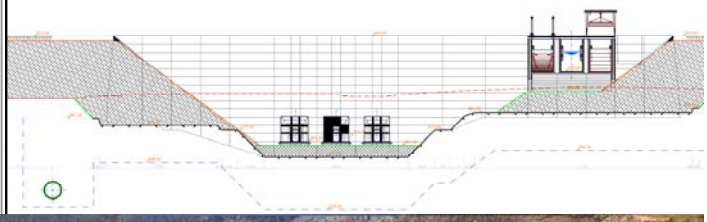
Type:	Concrete face rockfill dam
Rockfill/conc/vol:	70 000 m^3
Net head:	23.0 m

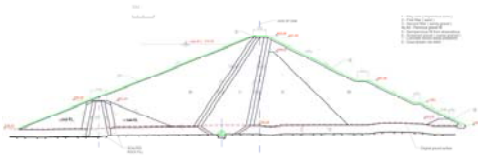
Project Description: The project consists of two dams (concrete arch and concrete face rockfill dam)

Dams were constructed in 1958. Around the end of 1961 dam failure occurred and the first sanation was performed afterwards. Secondary sanation measures were actualized by ENERGOPROJEKT-Hidroinzenjering.

TAQ-TAQ DAM AND IRRIGATION PROJECT

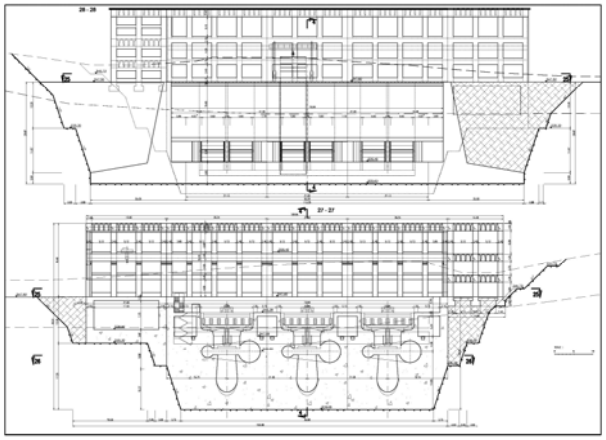


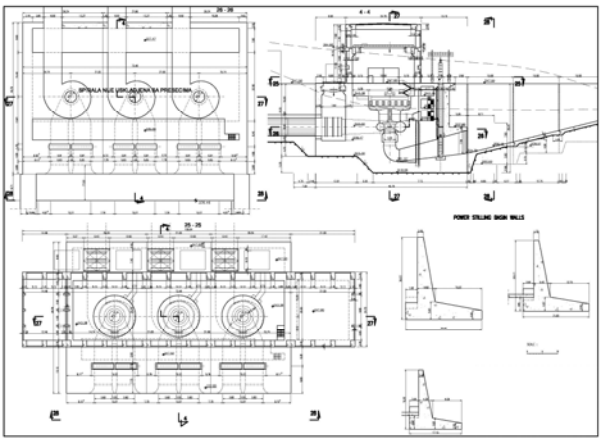


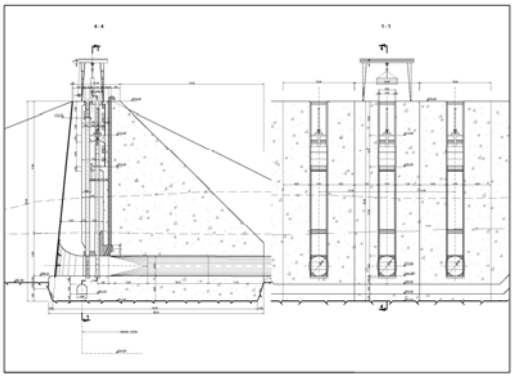


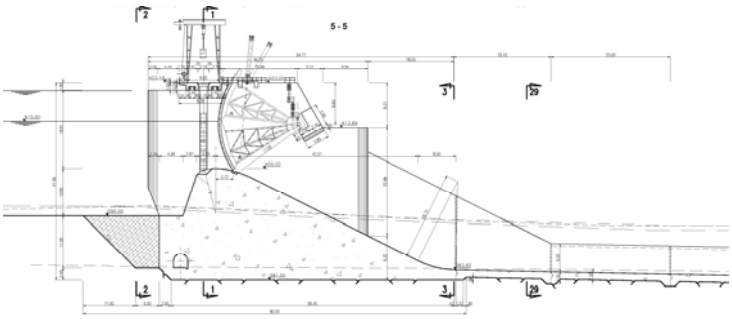
Contract title:	**PLANING REPORT & INVESTIGATION WORKS, FINAL DESIGN & TENDER DOCUMENTS FOR TAQ-TAQ DAM AND IRRIGATION PROJECT**
Location/River:	Taq-Taq town / Lesser Zab River – IRAQ
Employer:	Ministry of Water Resources IRAQ
Commencement date:	2004.
Completion date:	2010.
Contract price:	1,880,840.00 USD
Investments cost: (without Kirkuk Irrigation System)	920,000,000.00 USD

Hydrology data	
Catchment area	1850 km^2
Average discharge	217 m^3/s
PMF flood	8700 m^3/s
Dam	
Type	Fill dam with central clay core and concrete gravity part
Height	93 m
Crest length	1900 m
Embankment vol.	14 x 10^6 m^3
Concrete vol.	0.56 x 10^6 m^3
Reservoir total storage	2858 x 10^6 m^3
Spillway	
Type	Gated (radial gates) / 3 bays
HPP	
Installed capacity	270 MW (3 units)
Turbine type	Francis
Tunnels (diversion, bottom outlet, access)	
Diameters	8.0 & 6.5 m
Total length	1120 m
Irrigation area	
Kirkuk system	88,000 ha
Add. irrig. areas	16,000 ha









Description of the Project: Location of designed Taq-Taq Dam is on river Lesser Zab, some 5 km upstream from Taq-Taq town in Iraq. Taq-Taq Dam presents the second step on Lesser Zab River, downstream from Dokan Dam and upstream from Dibbis Dam. The main purpose of 2900 x 10^6 m^3 large Taq-Taq reservoir is irrigation, regulation of water released from Dokan power station, flood control for downstream area and power generation.

Taq-Taq Dam, 93 m high, is designed as a fill dam with central clay core. It will regulate the river average annual discharge providing the water for irrigation (Kirkuk irrigation system and other additional consumers).Three gated spillway bays with chute and ski jump bucket have sufficient capacity to convey the maximum designed flood with retention in the reservoir storage available. Designed power station has the installed capacity of 270 MW with discharge of 450 m^3/sec. Other appurtenant structures include diversion tunnels, bottom outlet, power intake and fuse plug.

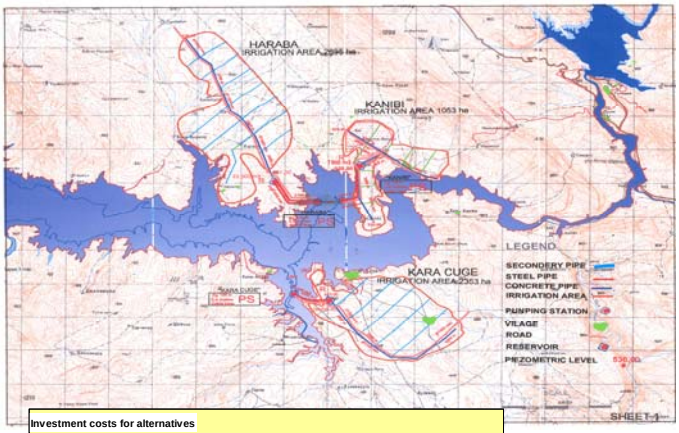
The Services Provided: Performance of Topographical & Geological Investigation Works and Preparation of Planning Report and Final Design with Tender Documents have been the most essential goals of the Project, including the following specific Consulting Services:

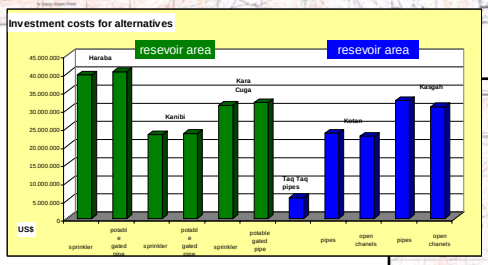
- Preparation of Investigation Works Program & Performance of Investigation Works;
- Determination of General Layout, optimization and engineering design of the Dam, Appurtenant Structures & HPP at Planning Report & Final Design stage;
- Preparation of Hydrological, Topographical, Geological & Earthquake Hazard Study at Planning Report stage;
- Preparation of Environmental Impact Assessment Study at Planning Report stage;
- Implementation of Cost Estimate with Construction Time Schedule at Planning Report & Final Design stage;
- Preparation of Economic & Financial Analysis at Planning Report stage;
- Preparation of Tender Documents, establishing of Tendering procedure and rendering assistance to Client during Tendering procedure.

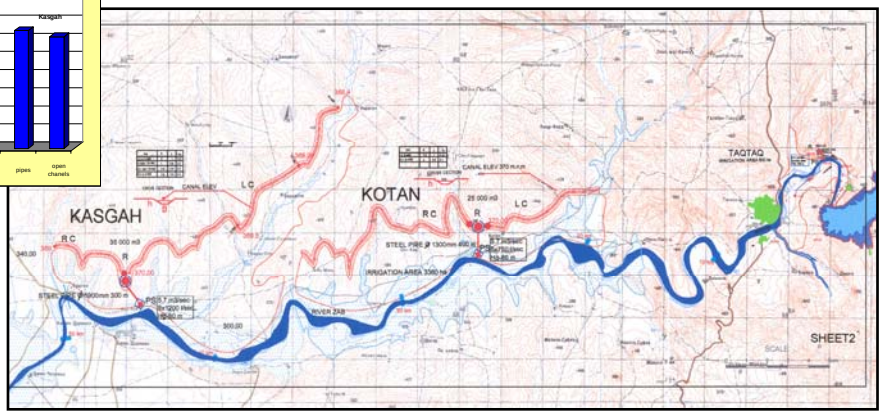
STUDY OF NEW IRRIGATION AREA IN TAQ-TAQ DAM VICINITY

Contract title:	**PRE-FEASIBILITY STUDY OF THE NEW IRRIGATION AREA – TAQ-TAQ DAM PROJECT**
Location/River:	Taq-Taq town / Lesser Zab River - IRAQ
Employer:	Ministry of Water Resources IRAQ
Commencement date:	2006.
Completion date:	2006.
Contract price:	1,880,840.00 USD
Investments cost:	920,000,000.00 USD

Hydrology data	
Catchment area	1,850 km^2
Average discharge	217 m^3/s
PMF flood	8,700 m^3/s
Dam	
Type	Fill dam with central clay core and concrete gravity part
Height	93.0 m
Crest length	1900 m
Embankment vol.	14 x 10^6 m^3
Concrete vol.	0.56 x 10^6 m^3
Reservoir total storage	2,858 x 10^6 m^3
Spillway	
Type	Gated / 3 bays
HPP	
Installed capacity	270 MW (3 units)
Turbina type	Fransis
New irrigation area	
In reservoir area	6,300 ha
Downstream of reservoir	8,965 ha







Description of the Project:

After construction of the designed Taq-Taq Dam, the area of 90 km^2 will be impounded, and total of 17000 inhabitants will be resettled. In order to mitigate negative effects induced by resettlements and to provide better life conditions possibility of resettlement to the region in the vicinity of the dam and reservoir as well as possibility and feasibility of irrigation of the new area which will be given as compensation was analyzed in the Pre-feasibility study.

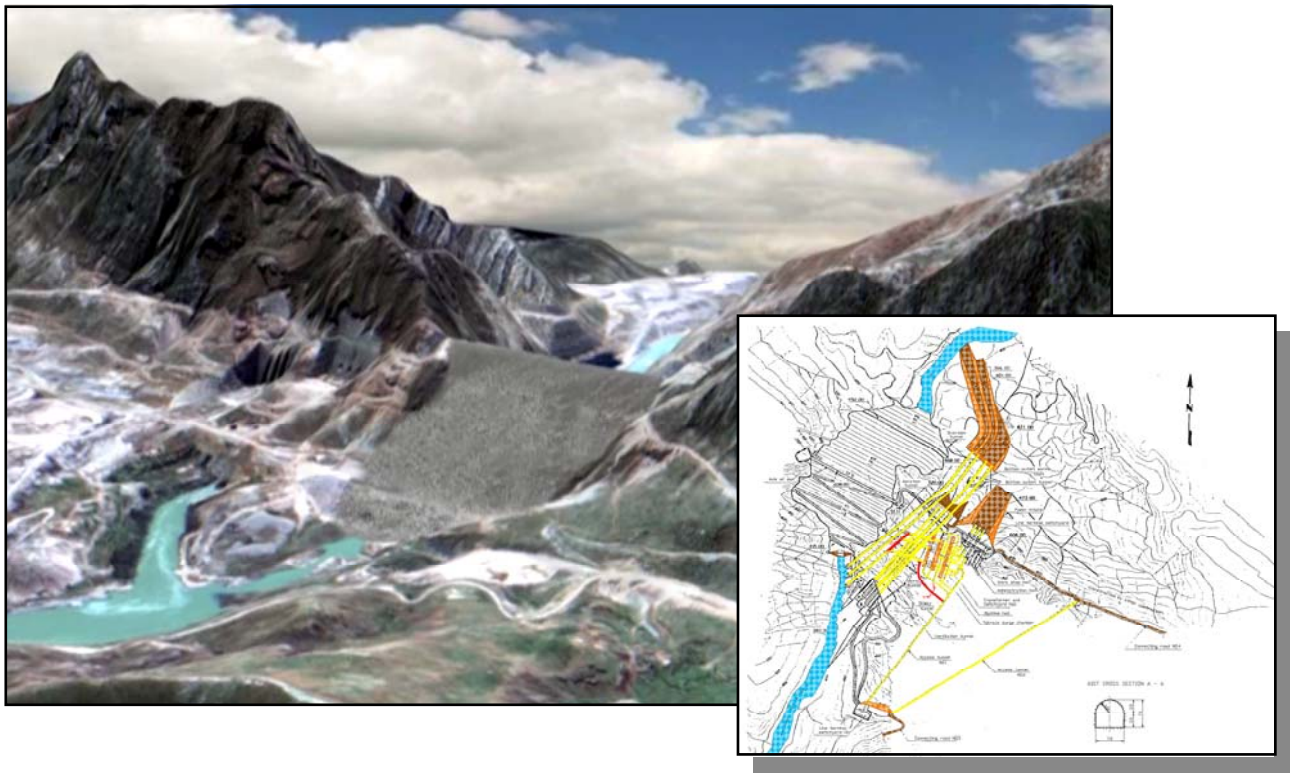
The appropriate areas for irrigation in the vicinity of dam (8,965 ha) and reservoir (6,300 ha) were determined based on the available maps and satellite images. Water demands were estimated in accordance with climatic characteristics, demands of typical crops in the area etc. Irrigation systems and their technical solutions were elaborated and costs and benefits estimated. Economical analyses were preformed and feasibility confirmed.

Additional study was performed to evaluate impact of new irrigation areas on the performance of the Taq-Taq reservoir. Additional water balance simulations indicated that the impact is negligible.

The Services Provided:

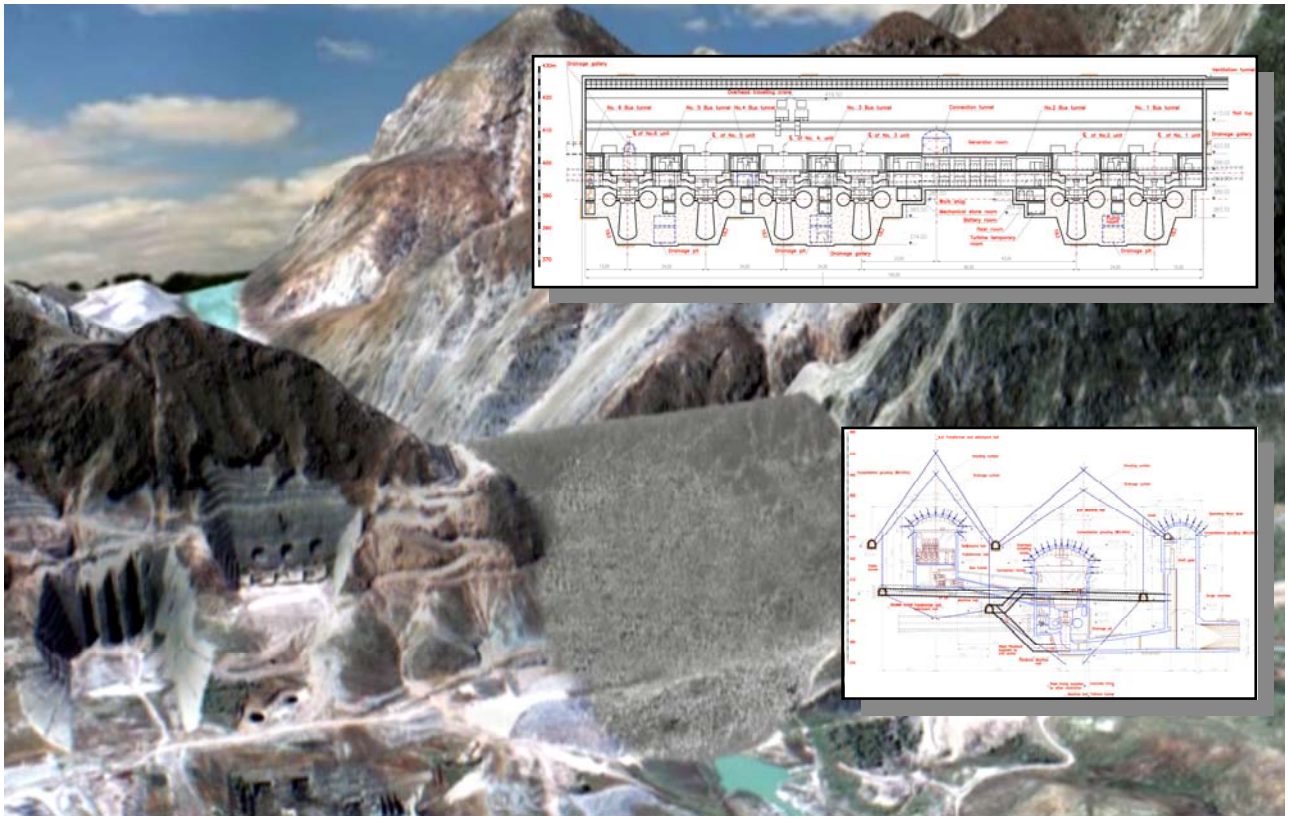
- Preparation and analyses of available documents and maps;
- Determination of general layout, and preliminary design of the irrigation systems;
- Implementation of Cost Estimate and Benefit analyses;
- Evaluation of new irrigation systems on original Taq-Taq Dam Project.

BEKHME DAM PROJECT



Contract title:	**UPDATING OF PLANNING REPORT & TENDER DOCUMENTS FOR BEKHME DAM**
Location/River:	Bekhme gorge / Greater Zab River IRAQ
Employer:	Ministry of Water Resources IRAQ
Commencement date:	2004.
Completion date:	2005.
Contract price:	1,200,000 USD
Investments cost:	3,100,000,000 USD

Hydrology data	
Catchment area	16600 km^2
Average discharge	377 m^3/s
PMF flood	25850 m^3/s
Dam	
Type	Rockfill dam with central clay core
Height	230 m
Crest length	600 m
Embankment vol.	34 x 10^6 m^3
Reservoir total storage	17000 x 10^6 m^3
Spillway	
Type	Gated (radial gates) / 3 tunnels
Capacity:	8865 m^3/s
HPP (underground)	
Installed capacity	1500 MW (6 units)
Turbine type	Fransis
Underground cavern	192 x 26 x 52 m
Tunnels (diversion, bottom outlet, spillway, power intake, access, ventilation)	
Diameters	8.0 ÷ 18.0 m
Total length	11000 m



Description of the Project: Main purpose of Bekhme Dam Project is power generation, irrigation and flood control. System is composed of the following structures: Rockfill dam; Spillway, Bottom outlet & Diversion tunnels; Water conveyance facilities; Underground power house, Transformer & Switchyard hall.

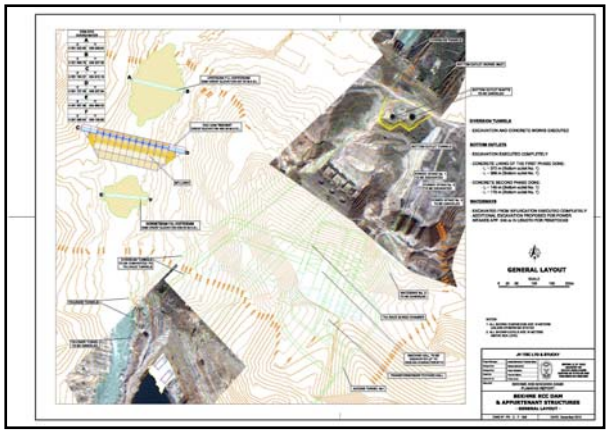
The commencement of Bekhme Dam Project construction, based on original EPDC (Japan) project was in 1986. The works were suspended in 1990, due to Kuwait-Iraq war together with the following UN sanctions and it haven't been continued, yet. The estimation of percentage of completed permanent works, made in 2004, was about 27%.

In the light of mentioned above the following Consulting Services within this Contract have been provided:

The Services Provided: Updating of original EPDC (Japan) Planning Report & Tender Documents have been the most essential goals of the project, including the following specific Consulting Services:

- Assistance to Ministry of Water Resources and State Commission for Dams and Reservoirs in continuing activities for Bekhme Dam Project;
- Review of status of executed works at Bekhme site;
- Engineering evaluation of the previous projects and works;
- Estimation of total cost of the remaining works;
- Updating of Hydrological, Topographical & Geological Report;
- Preparation of Environmental Impact Assessment Study;
- Updating of Contract Documents for Civil works & Equipment;
- Establishment of Tendering Procedure and rendering assistance to Client during Tendering Procedure.

BEKHME AND MINDAWA DAMS PROJECT – PLANNING REPORT



Contract title:	**BEKHME AND MINDAWA DAMS PROJECT - Planning Report**
Location/River:	North-Eastern part of Iraq/ Greater Zab River
Employer:	Ministry of Water Resources – Center of Studies and Engineering Design IRAQ
Commencement date:	September 2010.
Completion date (Updated Planning Report):	December 2010.
Contract price:	575,000.00 USD
Investments cost:	2,079,896,542.00 USD

Hydrology data

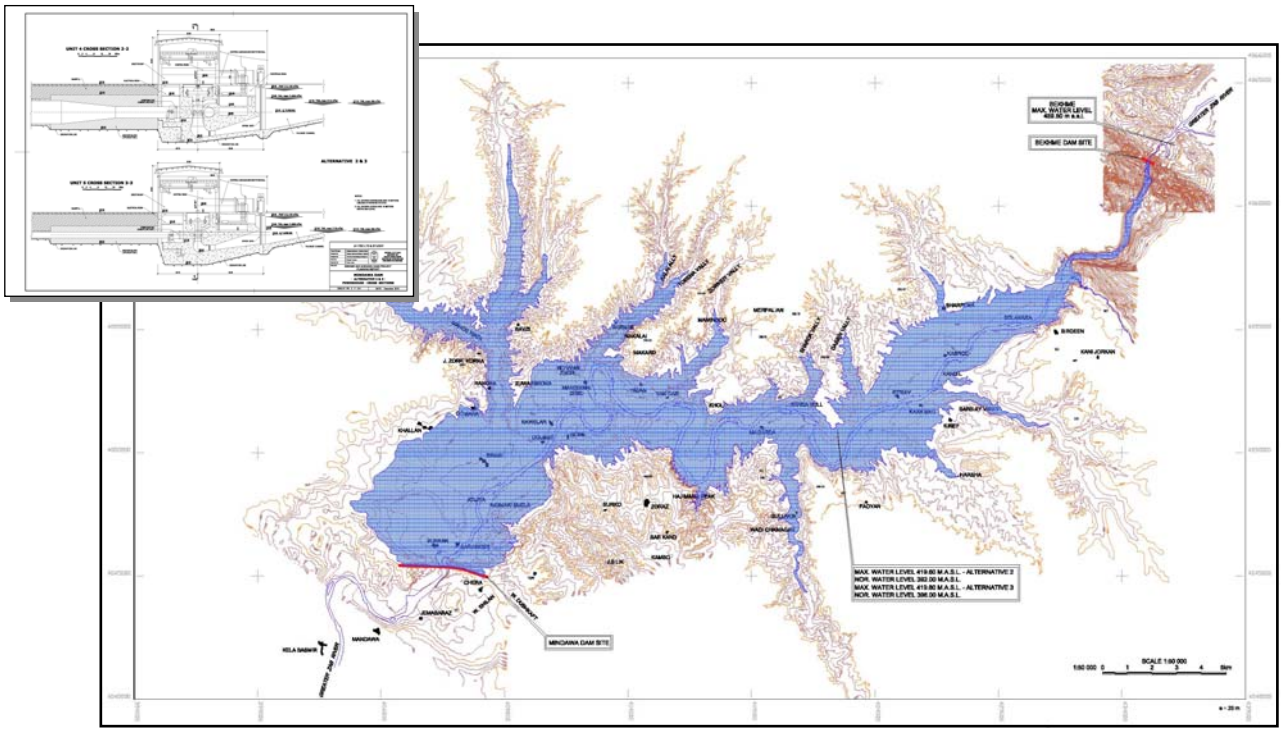
Catchment area	16600 km^2 (Bekhme Dam) 18200 km^2 (Mindawa Dam)
Average discharge	367 m^3/s (Bekhme Dam) 381 m^3/s (Mindawa Dam)
PMF flood	25850 m^3/s (Bekhme Dam) 31950 m^3/s (Mindawa Dam)

Bekhme Dam

Type	RCC Dam
Height	87 m
Crest length	299.33 m
Reservoir total storage	850 x 10^6 m^3
Spillway	
Type	Gated (radial gates) / 11 bays
HPP	
Installed capacity	200 MW (4 units)
Turbine type	Francis

Mindawa Dam

Type	Gravel fill dam with central clay core
Height	106 m
Crest length	3315 m
Reservoir total storage	4930 x 10^6 m^3
Spillway	
Type	Free overflow with chute and ski jump bucket
HPP	
Installed capacity	560 MW (4+1 units)
Turbine type	Francis
Irrigation area	
Area	215600 ha
Av. ann. water supply	98 m^3/s



Description of the Project: Bekhme and Mindawa Dams Project site is located in north-eastern part of Iraq, about 7 km upstream from Bekhme village (Bekhme Dam) and near Surkan Village – app 44 km downstream from Bekhme Dam site (Mindaawa Dam). This Project comprises analyses for the following alternatives:

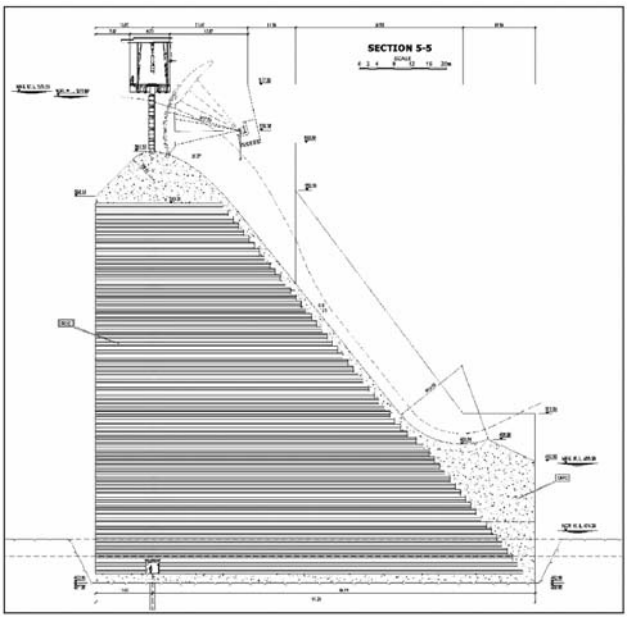
- Alternative 1 – Bekhme Dam with crest elevation at 460 m a.s.l. and multipurpose reservoir (irrigation and hydropower production). This reservoir can not be used for flood control. From reservoir, water for irrigation area of 59400 ha can be released. At HPP energy of app 1200 GWh average annually will be generated.
- Alternative 2 – Bekhme Dam with crest at elevation 460 m a.s.l. with Mindawa Dam located downstream. Bekhme Dam reservoir will be used for sediment control for Mindawa reservoir. River discharges will pass thorough Bekhme HPP without regulation and generated electric energy is app 1000 GWh average annually. From Mindawa, reservoir 98 m^3/s will be released for irrigation purposes thus providing irrigation area of 215600 ha. Mindawa reservoir is multipurpose reservoir and has enough capacity for flood control, irrigation and electric power generation. At Mindawa HPP energy of app 2000 GWh average annually will be generated.
- Alternative 3 – Mindawa Dam without Bekhme Dam upstream. Mindawa reservoir is multipurpose reservoir (flood control, irrigation and hydropower generation). From reservoir can be irrigated area of 96800 ha. At HPP electric energy of app 2000 GWh average annually will be generated.

According to feasibility study analyses Alternative 2 is proposed at the optimal one.

The Services Provided: Performance Planning Report comprises the following:

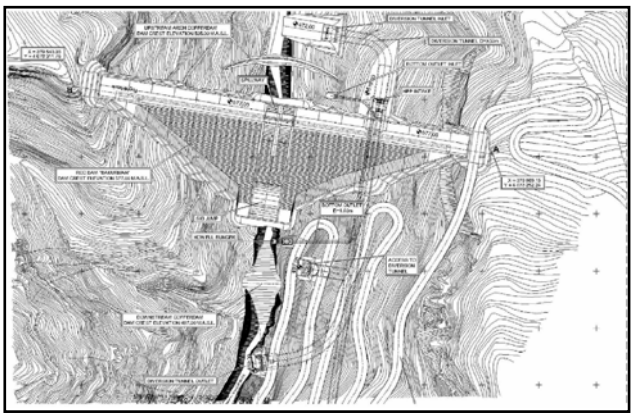
- Updating of topographic maps, geological and hydrological data
- Determination of General Layout, optimization and engineering design of both Dams, Appurtenant Structures & HPP for three alternatives
- Preparation of Feasibility study
- Preparation of Environmental Impact Assessment Study
- Preparation and issuing design criteria.

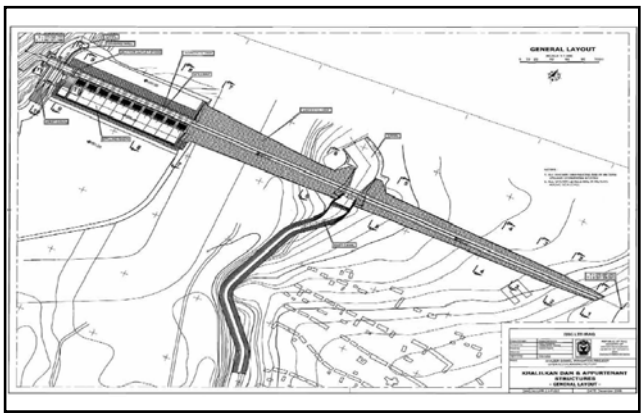
KHAZER-GOMEL IRRIGATION PROJECT



Contract title:	**KHAZER-GOMEL IRRIGATION PROJECT- Updated Planning Report, Final Design and Tender documents, Updated Final Irrigation Project and Tender documents**
Location/River:	40 km north-east from Mosul town / Khazer River – IRAQ
Employer:	Ministry of Water Resources IRAQ
Commencement date:	June 2009.
Completion date (Updated Planning Report):	June 2011.
Contract price:	1,509, 200.00 USD
Investments cost:	365, 430,933.00 USD

Hydrology data	
Catchment area	724 km^2 (Bakurman Dam) 930 km^2 (Khalilkan Dam)
Average discharge	13.6 m^3/s
PMF flood	4500 m^3/s
Bakurman Dam	
Type	RCC Dam
Height	115 m
Crest length	325 m
RCC vol.	648 000 m^3
Concrete vol.	205 000 m^3
Reservoir total storage	490 x 10^6 m^3
Spillway	
Type	Gated (radial gates) / 2 bays
HPP	
Installed capacity	70 MW (3 units)
Turbine type	Francis
Khalilkan Dam	
Type	Gravel fill dam with concrete diaphragm wall and concrete gravity part
Height	19.5 m
Crest length	583.70 m
Embankment vol.	90 554 m^3
Concrete vol.	102 756 m^3
Reservoir total storage	5.5 x 10^6 m^3
Spillway	
Type	Gated (radial gates) / 10 bays
Irrigation area	
Area	36 900 ha
Max water demand	25.85 m^3/s





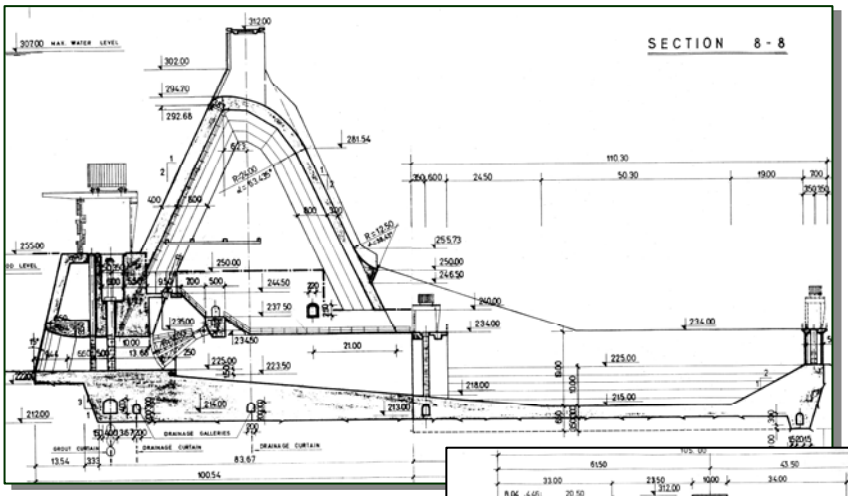
Description of the Project: Khazer-Gomel project site is located in north-eastern part of Iraq, about 40 km North-East from the Mosul town. The Khazer-Gomel Irrigation Project comprises the following main parts:

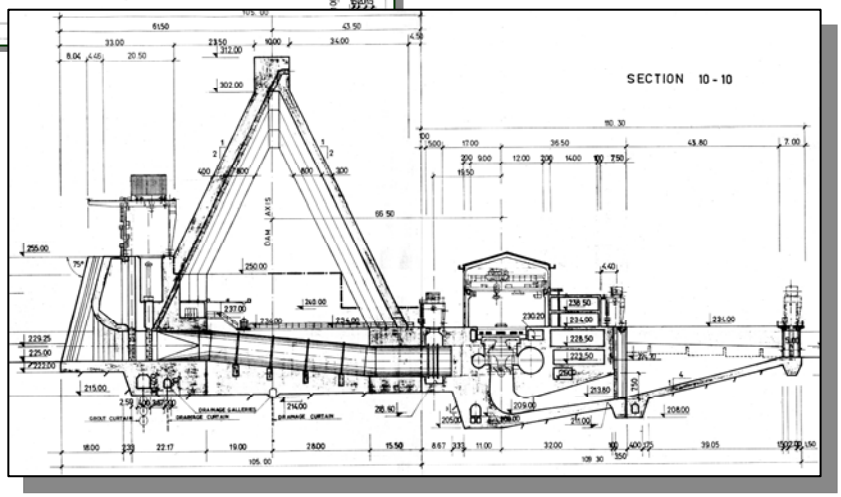
- Bakurman Dam with appurtenant structures and Hydro Power Plant (in following text named HPP) located on Khazer River near Bakurman village. This Dam with useful volume of reservoir 430 mil m^3 is storage Dam. Main purpose of its reservoir is storage water for irrigation and sanitary releases. As a by product of proposed water utilities is power generation. The power house with installed capacity of 70 MW, installed discharges of 82 m^3/s and three Francis units is proposed. Appurtenant structures of Bakurman Dam are: gated spillway with ski jump, diversion tunnel, bottom outlet-irrigation outlet, HPP intake with waterway.
- Khalilkan Dam with appurtenant structures and East and West Main Khazer channel intakes, situated on Khazer River about 27 km downstream from Bakurman Dam near Khalilkan and Kasruk villages. This dam is proposed as diversion Dam for daily discharge regulation. The useful volume of its reservoir is 2.25 mil m^3. The maximal discharge which is released to two main irrigation channels is 25.85 m^3/s. Appurtenant structures of this dam are: gated spillway with stilling basin, emergency bottom outlet, sanitary outlet, east main channel intake and west main channel intake.
- Irrigation area nearly downstream from Khalilkan Dam which cover total area of approximately 36 900 ha. Water for irrigation purposes is gravity distributed to this area by two main channels (east and west) with total length 54 km, 23 lateral channels with total length 147 km and 161 sublateral channels with total length of 533 km.

The Services Provided: Performance of Update of Planning Report is the first phase of Khazer-Gomel Irrigaiton Project and comprises the following:

- Updating of topographic maps and report
- Updating geotechnical report;
- Determination of General Layout, optimization and engineering design of both Dams, Appurtenant Structures & HPP;
- Updating irrigation report
- Implementation of Cost Estimate with Construction Time Schedule & Economic with Financial analysis;
- Preparation of Environmental Impact Assessment Study.

BADUSH I DAM PROJECT





Location:	The Tigris River, Iraq
Employer:	Technical Corps for Special Projects, Iraq
Commencement date:	1988.
Completion date:	1991.
Contract price:	M $ 23.62
Services provided:	Investigation Works Basic Design Final Design Detailed Design Construction Management Training of Client's Staff As-Built drawings

Dam:

Type:	Gravity concrete dam
Height	100 m
Rockfill/conc/vol:	4 900 000 (1 200 000) m^3
Reservoir capacity:	10 000 x 10^6 m^3

Power plant

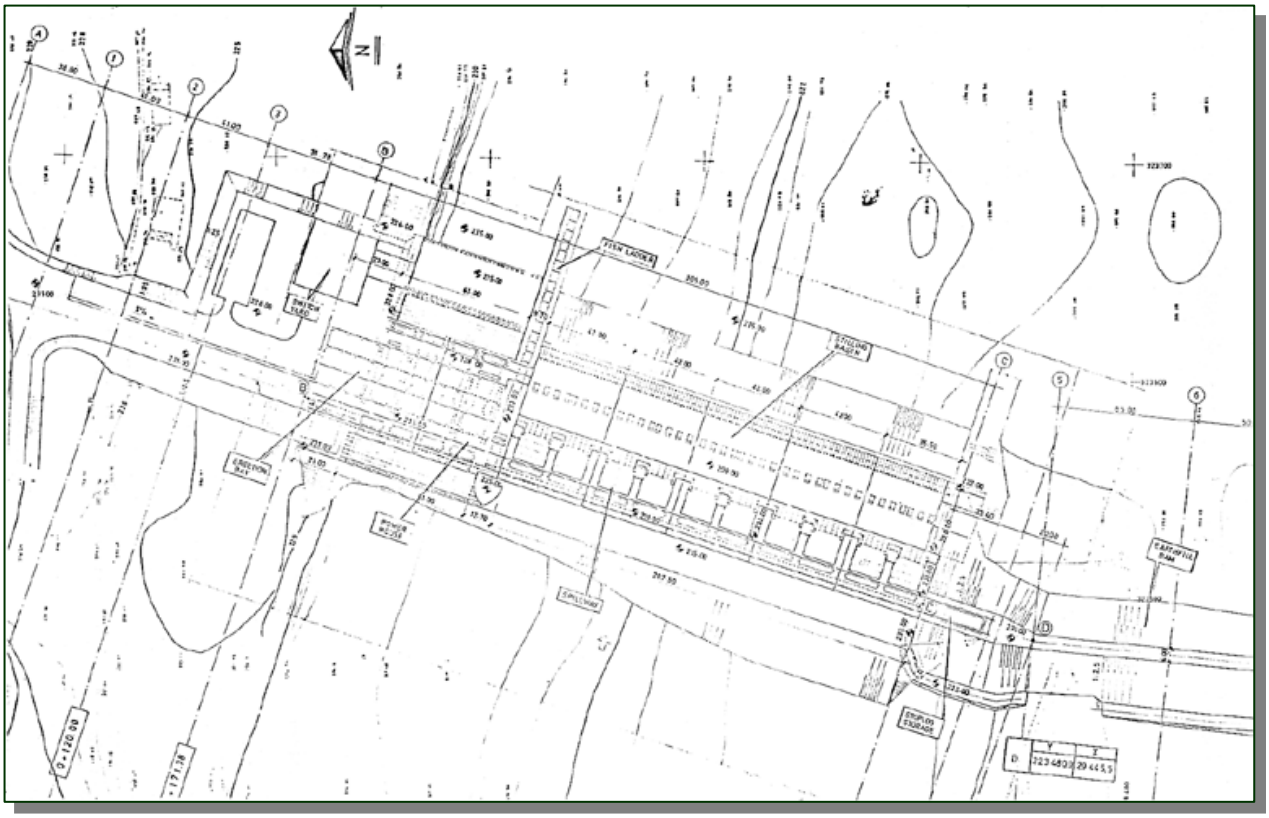
Turbines:	4 Kaplan
Installed capacity:	170 MW
Net head:	100 m

Spillway

Capacity:	7 250 m^3
Type:	Radial gate on the dam top

Project Description: The Badush Hydroelectric Project, located in the northern part of Iraq, is a multi purpose project intended to provide flood control, power generation and conditions for guaranteed operation of Saddam Power Plant. Project is composed of the following structures: Main Earth Dam with inclined clay core, Saddle dam – earth dam on the left river bank, concrete dam – hollow gravity type on the right river bank, with bottom outlets, spillway and power house in the vicinity of concrete dam toe.

BADUSH II DAM PROJECT

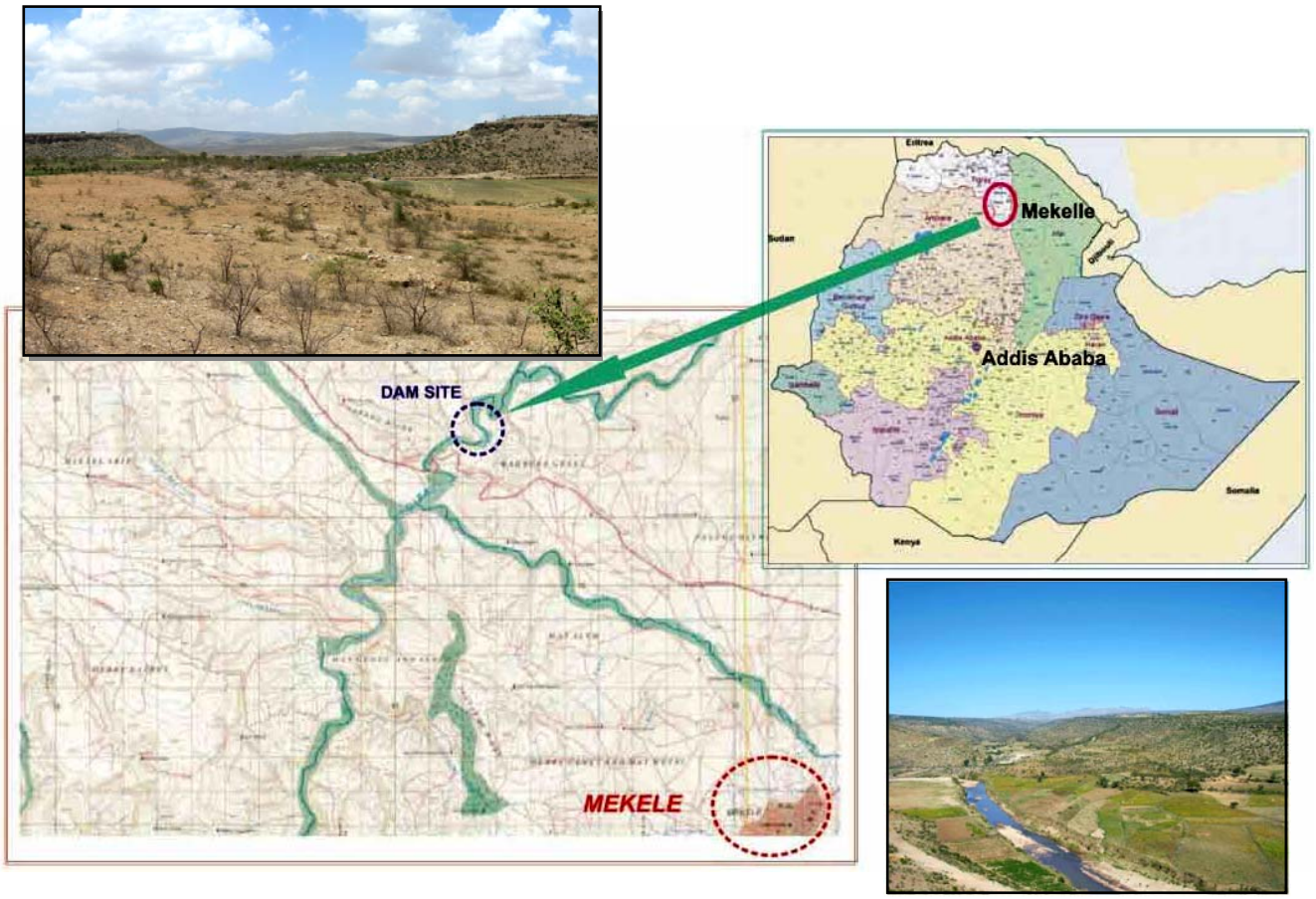


Location:	The Tigris River, Iraq
Employer:	Technical Corps for Special Projects, Iraq
Commencement date:	1988.
Completion date:	1991.
Contract price:	M $ 7.62
Services provided:	Investigation Works Basic Design Final Design Training of Client's Staff

Dam:	
Type:	Gravity concrete dam
Height	26 m
Power plant	
Turbines:	4 Bulb Pit
Spillway	
Type:	10 Radial gate on the dam top

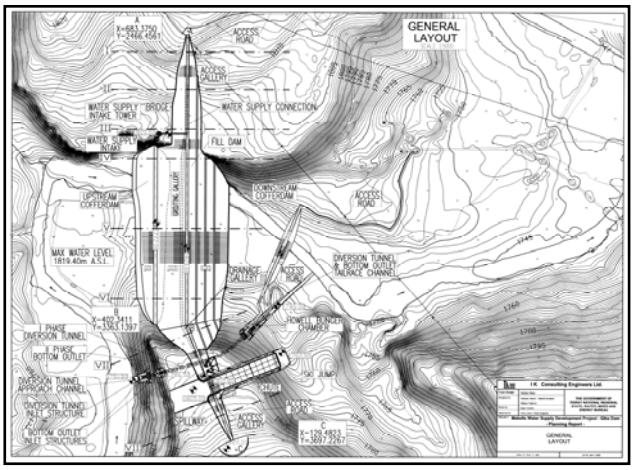
Project Description: The Badush II Hydroelectric Project, located in the northern part of Iraq, is a multi purpose project intended to provide flood control, power generation. Project is composed of the following structures: concrete gravity dam, spillway and power house.

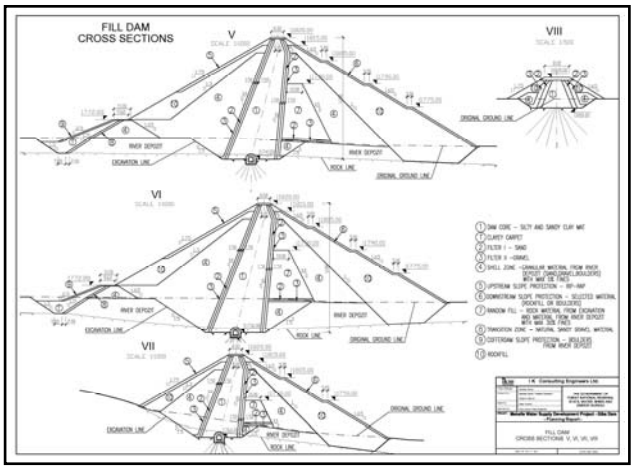
GIBA DAM PROJECT
- PLANNING REPORT -



Contract title:	**MEKELLE WATER SUPPLY DEVELOPMENT PROJECT-GIBA DAM Planning Report**
Location/River:	15 km north-east from Mekelle town / Giba River – Ethiopia
Employer:	Tigary Water Resources, Mineral and Energy Bureau of the Government of Tigary Nationaly Regional State Ethiopia
Commencement date:	November 2008.
Completion date:	June 2009.
Contract price:	137,500 €
Investments cost:	132,595,034.3 USD

Hydrology data	
Catchment area	2,540 km^2
Average annual inflow	8.0 m^3/s
PMF flood	3,062 m^3/s
Giba Dam	
Type	Fill dam with central clay core
Height	84.0 m
Crest length	1,325.0 m
Crest elevation	1,820.00 m a.s.l.
Embankment vol.	6,635,119 m^3
Reservoir total storage	93.5 x 10^6 m^3
Spillway	
Type	Free overflow frontal spillway
Tunnel (diversion)	
Diameter	8.50 m
Total length	380.0 m





Description of the Project:

The main objective of Giba Dam Project is to provide water supply for Mekelle city, capital of Tigary Regional State in the northern part of Ethiopia. Dam site location is some 15 km north-east from Mekelle town.

Mekelle Town water demand is 124,300 m^3/day, while water abstraction from the reservoir, with live storage capacity of 93.5 millions m^3, is 147,022 m^3/day.

Giba dam is designed as a fill dam consisting of impervious clayey core zone and upstream and downstream supporting shells made by compacted river and higher terraces deposits. Appurtenant structures includes free overflow frontal spillway with chute and ski jump bucket, diversion tunnel, water intake tower, bottom outlet.

The Services Provided:

Performance of Planning Report comprises the following specific Consulting Services:

- Review and engineering evaluation of the previous projects and works
- Preparation of Reservoir Operation Study
- Performance of Geological Report Overview
- Determination of general layout, optimization and engineering design of the dam and appurtenant structures
- Implementation of Cost Estimate with Construction Time Schedule

CURU MUY DAM PROJECT

Location: Peru

Employer: Cindicato electrico

Commencement date: 1995.

Completion date: 1998.

Contract price: M $ 16

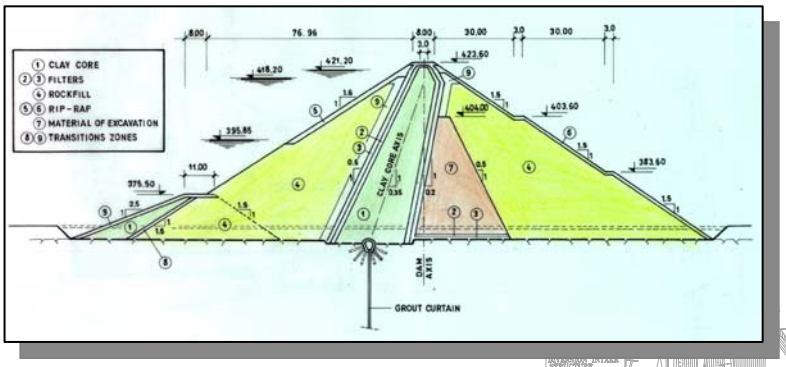
Services provided: Basic Design
Final Design
Construction Supervision

Power plant

Turbines:	2 Kaplan
Installed capacity:	2 x 18 m^3/s / 2 x 6.23 MW
Net head:	39.3 m

Project Description: Low head power plant, run-off river type total installed power 12 MW

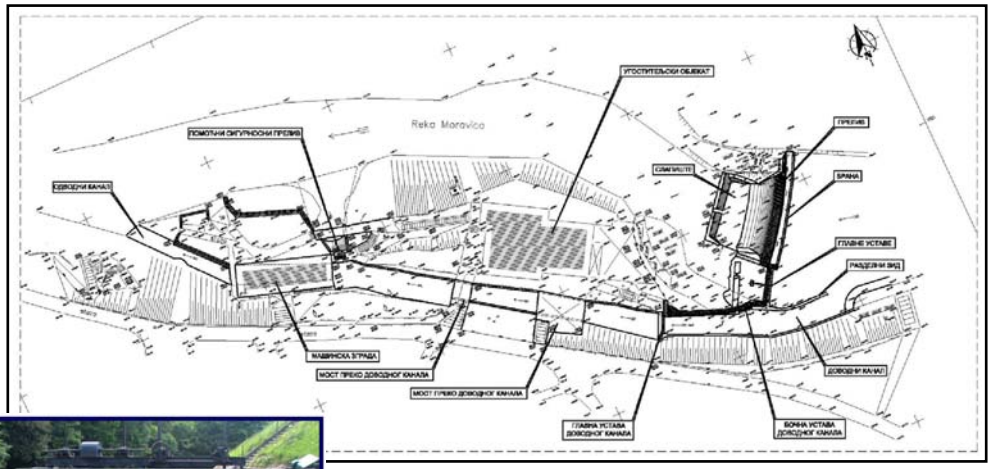
SVRACKOVO DAM PROJECT



Location:	The Rzav River	Dam	
		Type:	Rockfill with clay core
Employer:	Electricity Authority of Serbia	Height:	68 m
		Rockfill/conc.vol.:	590 100 m^3
Commencement date:	1999.	Reservoir capacity:	27 x 10^6 m^3
Completion date:	Under preparation	Power plant	
		Turbines:	2 Francis
Contract price:	M $ 50	Installed capacity:	7.2 MW
	(for Construction)	Net head:	53.5 m
Services provided:	Investigation works		
	Basic design	Spillway	
	Feasibility study	Capacity:	1150 m^3/s
	Final design	Type	Morning glory
	Detailed design		
		Tunnels	
		Length:	190/190/130/75
		Diameter:	8.50/2.00/2.00/2.50

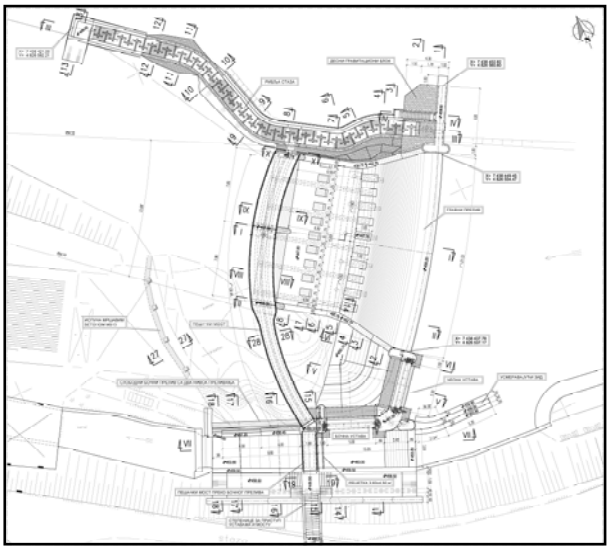
Description of the Project: Rzav multipurpose system includes regional water supply system and power plant. System is composed of the following structures: rockfill dam, morning glory spillway, bottom outlet, intake structure and power house.

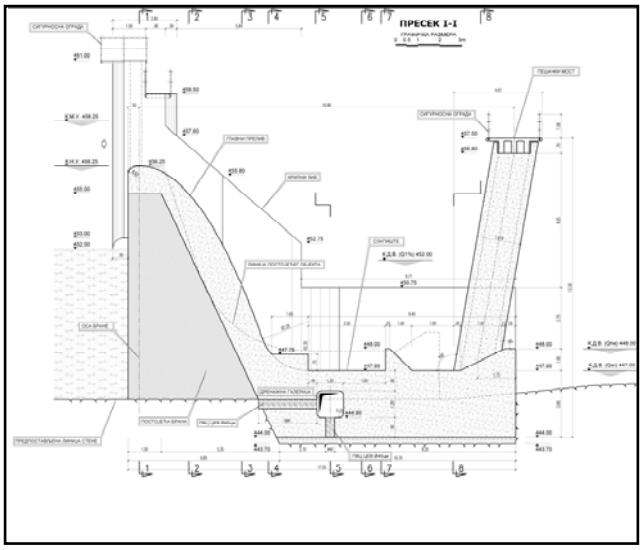
REHABILITATION AND RECONSTRUCTION OF DAM HPP "MORAVICA"



Contract title:	**FINAL ENGINEERING DESIGN FOR REHABILITATION AND RECONSTRUCTION OF CONSTRUCTION PART OF HPP "MORAVICA" IN IVANJICA**
Location/River:	Ivanjica / River Moravica SERBIA
Employer:	"Elektrosrbija" Ltd. Kraljevo Department Cacak Drive Ivanjica SERBIA
Commencement date:	2008.
Completion date:	2009.
Contract price:	20,000.00 EUR
Investments cost:	1,000,000.00 EUR

Hidrological data	
100 year flood	348 m^3/s
Mean discharge	6.72 m^3/s
PMF	2870 m^3/s
Dam-Water intake	
Type	Concrete-rockfill arch dam
Height	~10 m
Crest length	21.0 m
Concrete volume	0.26 x 10^6 m^3
Auxiliary objects	Concrete dam with water-gates, water intake and head race channel for HPP, outlet
HPP	
Installed capacity	4.8 MW





Description of the Project:

Small hydro-power plant Moravica, with all appurtenant structures, is located on Moravica River in the center of Ivanjica city. Small HPP is intended for production of electricity, also it has cultural, historic and tourist importance for “Elektrosrbija” Company and for the Ivanjica city. Existing dam was built in 1909 year.

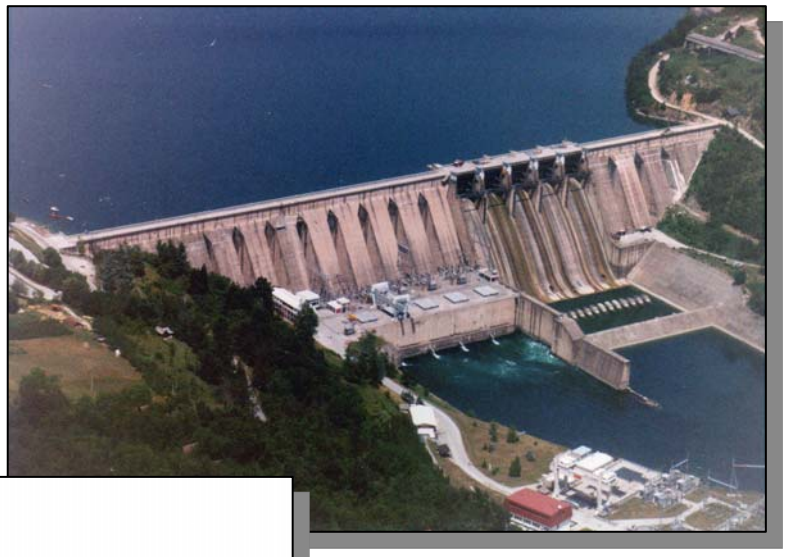
Next to HPP, following existing structures are located: concrete dam with stilling basin, gated concrete sill, intake and head water channel for hydro-power plant with auxiliary gate in front of power-plant and tail-race channel. Dam is concrete-rock-fill arch, height around 10 m. Since that the dam and following objects are in very bad condition, analysis of present state of structures is performed, and all necessary measures for reconstruction of the structures, with providing this full security, are proposed.

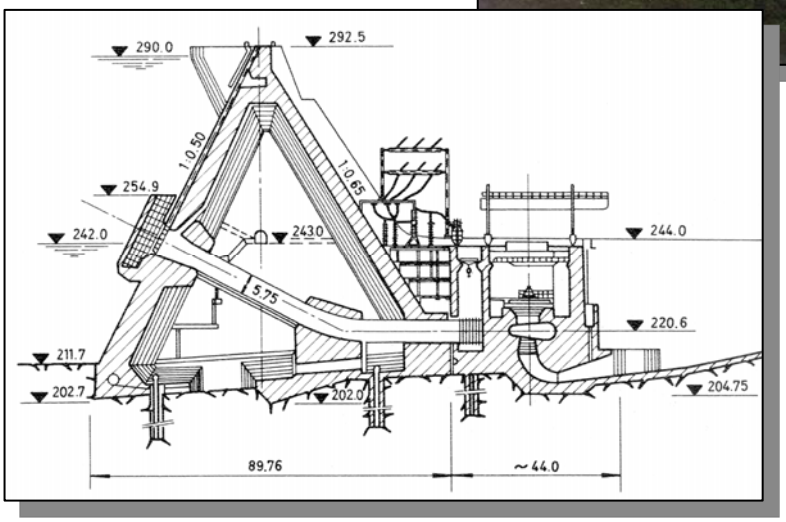
The following protection measures of rehabilitation and reconstruction are proposed: rehabilitation of the fissure system, in dam body by grouting, construction new hydraulically shaped spillway crest, deconstruction and construction of a new stilling basin with end sill and two lines of chute blocks, deconstruction of existing spillways and corresponding part of head water channel and construction of new gated sill, and as well as side spillway, construction of fish ladder on a right side of a dam, construction of foot-access bridge, rehabilitation of corresponding spillway at power house by concreting and creating concrete plunge pool, rehabilitation of channel walls by drainage and grouting.

The Services Provided:

- Review of existing technical documentation
- Additionally detail site measurements and survey
- Exploratory boring at the dam
- Analysis the present state and proposing alternative for reconstruction and rehabilitation of the structures
- Engineering design (hydraulic, static, stability and dynamic)
- Implementation of cost estimates with construction time schedules.

BAJINA BASTA DAM PROJECT



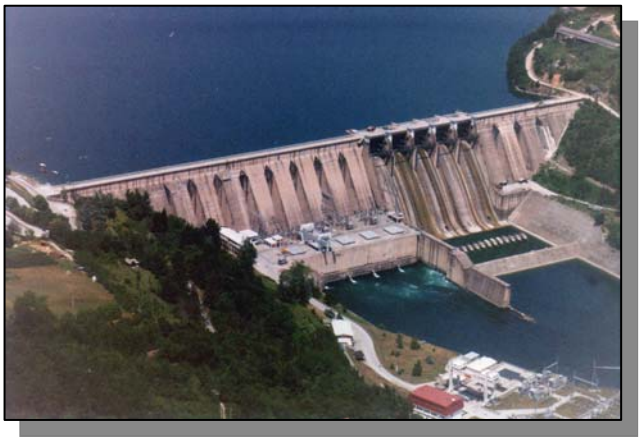


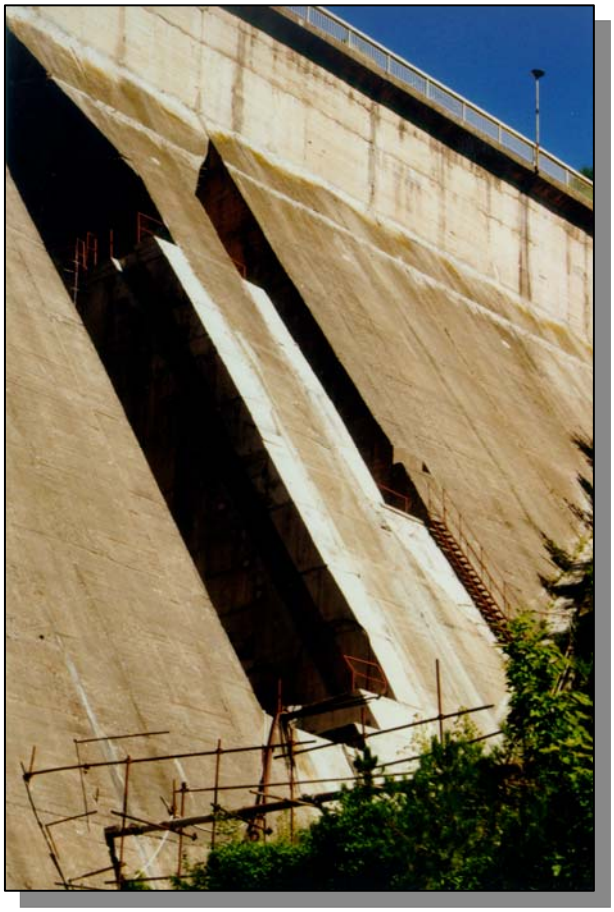
Location:	The Drina River, Yugoslavia
Employer:	Electricity Authority of Serbia
Commencement date:	1963.
Completion date:	1967.
Contract price:	M $ 8.0
Services provided:	-Pre-feasibility Study -Investigation Works -Final and Detail Design -Tender Documents -Construction Supervision -As-Built Drawings -Monitoring and Observation

<u>Dam</u>	
Type:	Hollow gravity dam
Height:	90 m
Rockfill/conc.vol.:	995 000 m^3
Reservoir capacity:	340 x 10^6 m^3
<u>Power plant</u>	
Turbines:	4 Frances
Installed capacity:	348 MW
Net head:	67 m
<u>Spillway</u>	
Capacity:	10 600 m^3/s
Type:	Overflowing dam (5 radial gates)

Description of the Project: Main purposes of Bajina Basta Dam Project are power generation flood control, irrigation and water supply.

REPAIR OF THE BAJINA BASTA DAM PROJECT





Location:	The Drina River, Yugoslavia
Employer:	Electricity Authority of Serbia
Commencement date:	1994.
Completion date:	Under construction
Contract price:	M $ 15

Dam

Type:	Hollow gravity dam
Height:	90 m
Concrete vol.:	995.000 m^3
Reservoir capacity:	340 x 10^6 m^3

Reparation

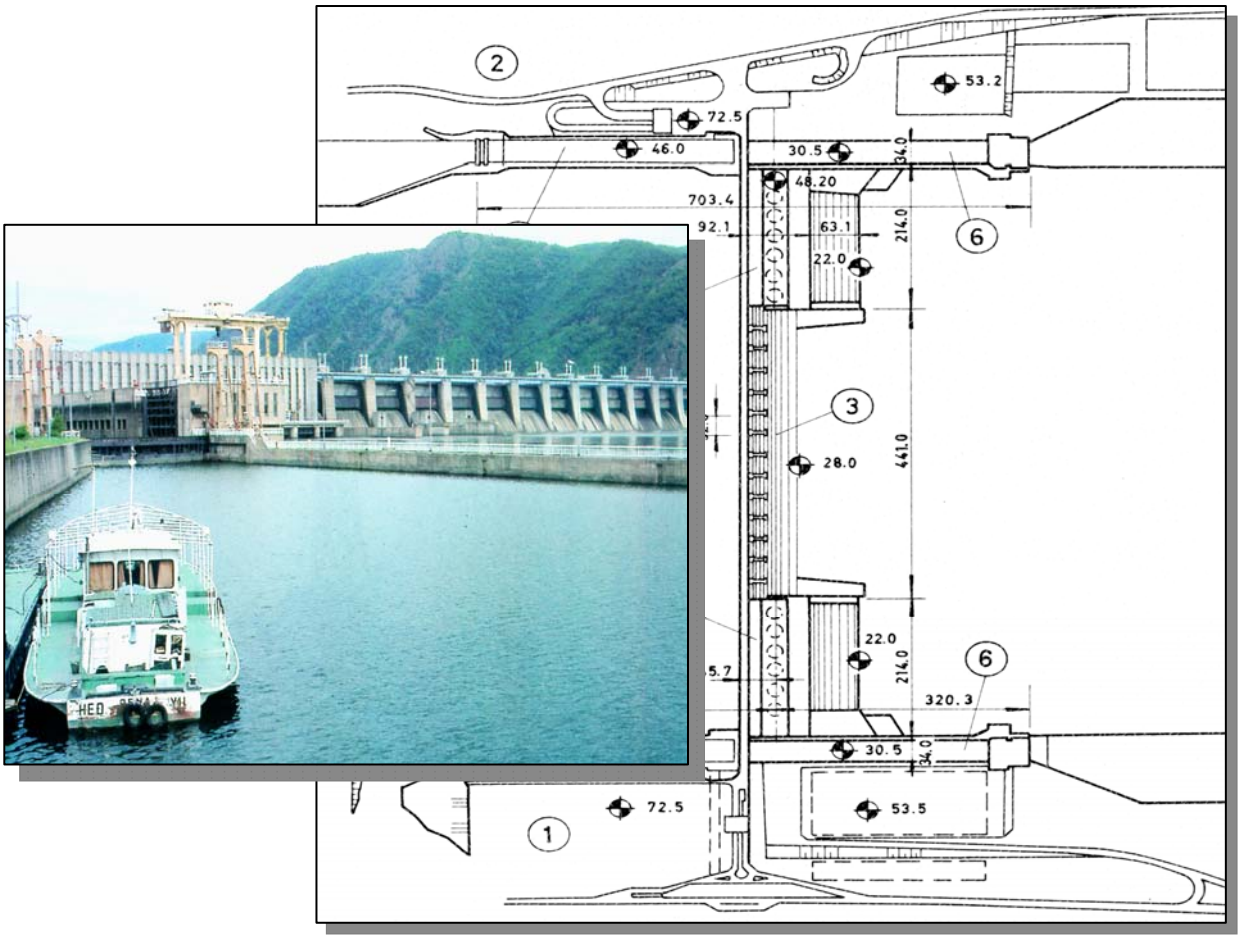
Concrete vol.:	30 000 m^3
Anchors (cables):	364

Services provided:

-Feasibility Study
-Investigation Works
-Final and Detail Design
-Construction Supervision
-As-Built Drawings

Description of the Project: Left abutment repair, due the occurrence of cracks system in the buttresses walls. The repair involved additional filling of 30 000 m^3 concrete and prestressed with cables.

IRON GATE No. 1 DAM PROJECT

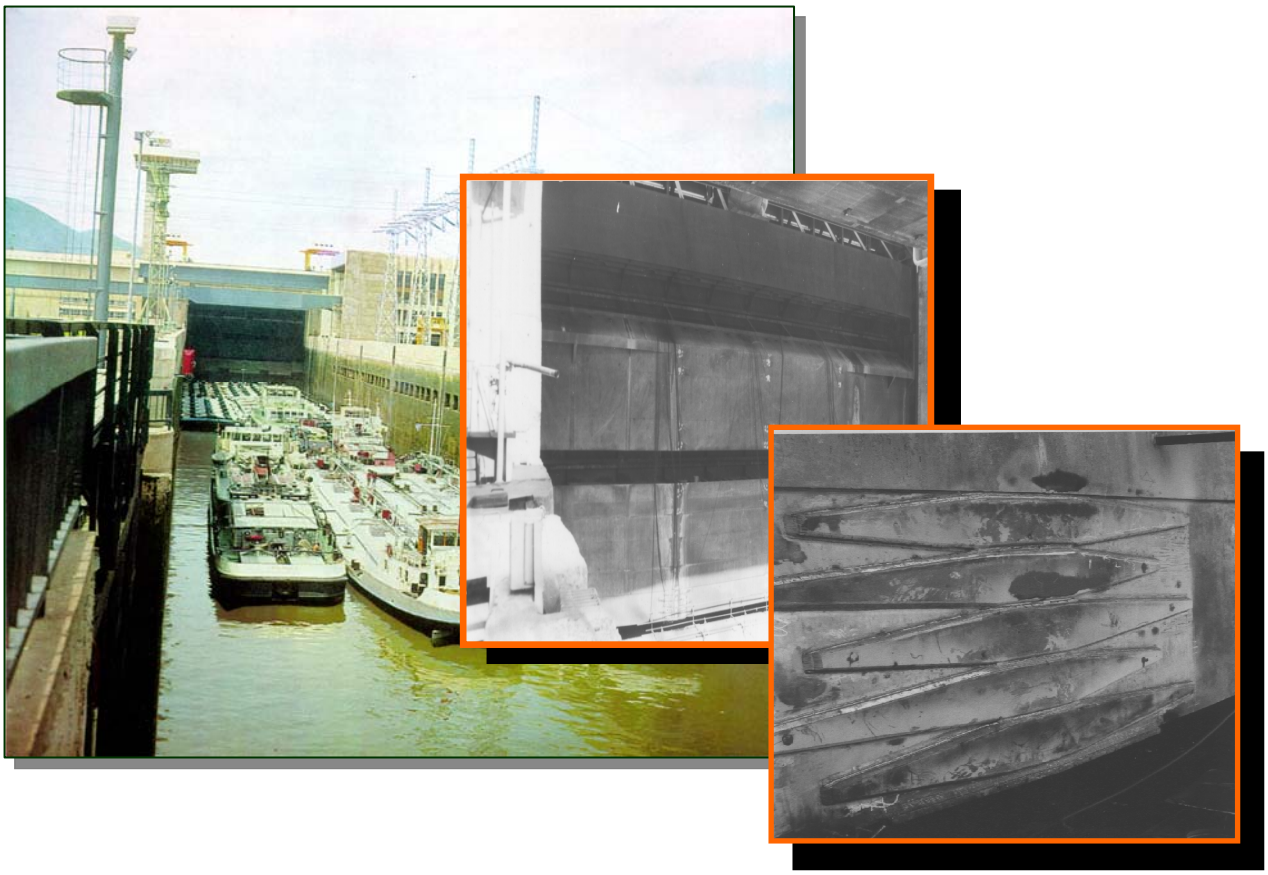


Location:	Danube River, Yugoslavia
Employer:	Electricity Authority of Serbia
Commencement date:	1965.
Completion date:	1971.
Contract price:	M $ 17
Services provided:	-Final Design -Detail Design -Construction Supervision -Dam Monitoring and bservation1

Dam:	
Type:	Gravity concrete dam
Height	59 m
Concrete vol:	3 x 10^6 m^3
Reservoir capacity:	2550 x 10^6 m^3
Power plant	
Turbines:	12 Kaplan
Installed capacity:	2 050 MW
Net head:	34.50 m
Spillway	
Capacity:	10 500 m^3/sec
Type:	14 bays, gated
Navigation lock:	
Type:	two step
Clearance:	34 m x 310 m

Project Description: The Iron Gate No. 1 binationally shared Danube River by Yugoslavia and Romania. This hydropower and navigation complex consists of the power plant, concrete spillway and navigation lock. The purpose is power production and navigation of a river traffic.

NAVIGATION LOCK STEEL GATE REPARATION Iron gate 1 dam



Location:	Danube River, Yugoslavia
Employer:	Electricity Authority of Serbia
Commencement date:	1995.
Completion date:	2000.
Contract price:	M $ 1.2
Services provided:	-Final Design -Detail Design -Construction Supervision -Monitoring and observational

Navigation lock:

Type:	Two steps
Height	59 m
Clearance:	34 m x 310 m

Steel gate on the middle head

Type:	Steel stoplog
Height:	23.1 m
Span:	34.00 m

IRON GATE No. 2 DAM PROJECT

Location:	Danube River, Yugoslavia
Employer:	Electricity Authority of Serbia
Commencement date:	1977.
Completion date:	1987.
Contract price:	M $ 17
Services provided:	Final Design Detail Design Construction Supervision * Note: Services rendered in JV with Institute for Hydro-energetic Studies & Design, Bucharest, Romania

Dam:

Type:	Gravity dam/ Fill dam
Height	32 m/35 m
Rockfill/conc/vol:	10 x 10^6 m^3 / 2 x 10^6 m^3
Reservoir capacity:	80 km u/s to Iron Gate No.1

Power plant

Turbines:	8 Kaplan, bulb type
Installed capacity:	216 MW
Net head:	7.45 m

Spillway

Capacity:	7875 m^3/sec
Type:	7 bays, gated

Navigation lock:

Type:	one step
Clearance:	34 m x 310 m

Project Description: The Iron Gate No 2 Dam lies 8o km downstream of the Iron Gate No. 1 on the binationally shared Danube River by Yugoslavia and Romania. This hydropower and navigation complex consists of the power plant, earthfill dam, concrete spillway and navigation lock. The purpose is power production and navigation of river traffic.

STUDY OF MAINTAINING, MANAGING AND MONITORING ON EXISTING HIGH DAMS AND RESERVOIRS IN SERBIA

Contract title:	**STUDY REPORT ON MAINTAINING, MANAGING AND MONITORING ON EXISTING HIGH DAMS AND ARESERVOIRS IN SERBIA**
Location:	Serbia
Employer:	"SRBIJAVODE" Water Authority, Belgrade
Commencement date:	2005
Completion date:	2005
Contract price:	42,000 €
Investments cost:	

Number of dams 28

Number of dams depending of height:

Height	Number of dams
> 50 m	7
30 – 50 m	11
15 – 30 m	10





Description of the Project: Serbia has 26 large dams with reservoir storage larger than 10 million m^3 and 34 large dams with reservoir storage lesser than 10 million m^3. Due to the economical situation in the last decades, maintenance and monitoring of these dams was not adequate. This has a direct influence on safety of the dam and region downstream of the dam. Lack of adequate management has its consequences in waste of water resources, decrease of water quality in the reservoir etc. The main objectives of this study were to do the assessment of the 28 existing large dams in Serbia and to propose measures/procedures of their monitoring, maintenance and management.

Information related to the technical and legal aspects of all 28 dams were gathered, analyzed and systematized in a form of digital Data base (in Access) connected with GIS (ArcView GIS). For each dam, conclusions related to its present state are given, as well as lists of missing technical documentation and all necessary activities which have to be performed in the area of monitoring, maintenance and management. Necessary activities, which are common for all considered dams are: preparation of missing project/reports, sanation works, check of hydro-mechanical equipment, geodetic measurements of reservoir, revitalization and innovation of the monitoring system, innovation of hydrological data and related parameters, etc. Recommendations were given related to the possible pragmatic ways of achievement of necessary dam safety and increase of economical effects of considered dams and reservoirs. Special conclusions are given related to the possibility of increase of hydropower production at each dam location.

Establishment of a unique information system for all large dams and reservoirs in Serbia is a must, and that was emphasized within this study. Database developed in this study is an example how the database for all dams could be organized.

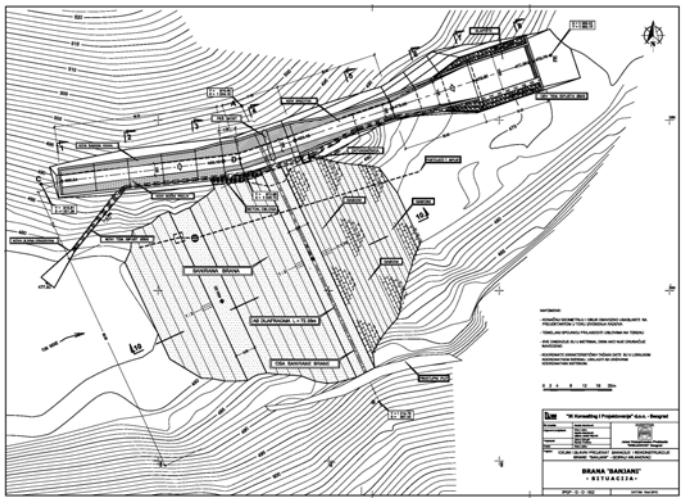
The Services Provided:

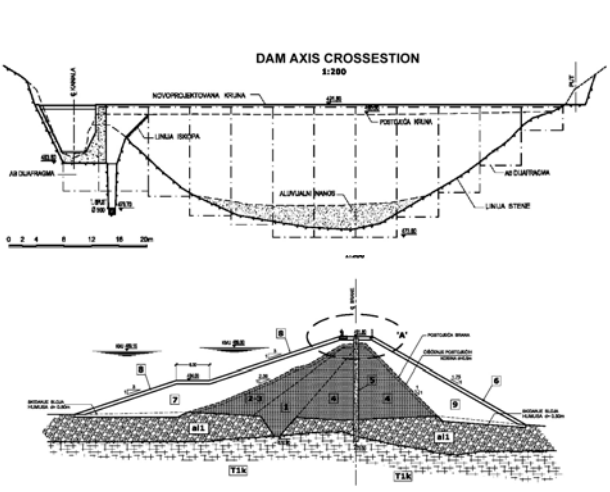
- Determining of existing dams stability
- Defining of measures for dams stability improvement
- Data and documentation collecting
- Site Reconnaissance
- Recording of sites due to preparation of Maintaining, Managing and Monitoring Reports
- Preparation of Maintaining, Managing and Monitoring Reports on Dams
- Defining of work improvement measures
- Defining of the Plan for further works

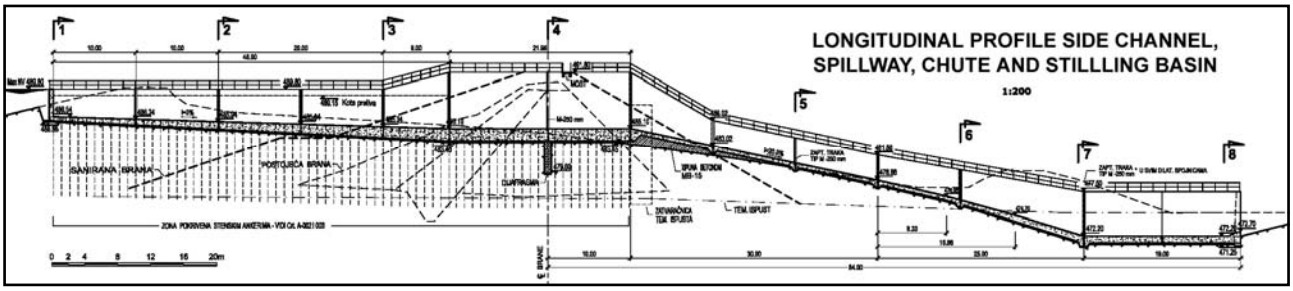
PLANNING REPORT AND FINAL DESIGN FOR BANJANI DAM RECONSTRUCTION NEAR GORNJI MILANOVAC TOWN

Contract title:	**PLANNING REPORT AND FINAL DESIGN FOR BANJANI DAM RECONSTRUCTION NEAR GORNJI MILANOVAC TOWN**
Location / river	1 km upstream from Gornji Banjani village – Velika Dicina River
Employer:	PWMC "Srbijavode" – Belgrade - Serbia
Commencement date:	2008.
Completion date:	2010.
Contract price:	6,500,000.00 RSD
Investments cost:	2,510,658.00 EUR

Hydrology data	
Catchment area	25.4 km^2
Average discharge	0.271 m^3/s
$Q_{0,01\%}$	131 m^3/s
Dam	
Type	Rockfill with central concrete diaphragm wall
Height	18 m
Crest length	67 m
Reservoir total storage	360 000 m^3
Spillway	
Type	Side channel with chute channel and stilling basin







Description of the Project: Existing Banjani Dam with appurtenant structures, which is located on Velika Dicina River app. 1 km upstream from Gornje Banjani village, is seriously damaged. Damages of dam in present state can cause its collapse and could jeopardize citizens of downstream village and town. Reconstruction of dam comprises the civil works in order to provide its stability without important changes of its existing geometry, demolition of existing hydraulically no shaped spillway sill and construction or new hydraulically designed side channel spillway with chute and stilling basin, closing of existing bottom outlet and construction of new one according to hydraulic design criteria, construction of new and reconstruction of existing damaged monitoring equipment. Reconstruction of dam body comprises increasing its height above existing crest elevation for 1 m, reconstruction upstream face by earth embankment with cover formed by stone deposit, reconstruction of downstream face by rockfill embankment and gabions, construction of reinforcement concrete diaphragm in dam body axis and construction of complete new spillway with capacity for 100-year flood occurrence. New spillway has enough capacity for safety conveyance oa 10000-year flood occurrence. Reservoir is used for flood control as in present state.

The Services Provided: Performance of Planning Report and Final Design of Banjani Dam Project comprises the following:

- Collection and analyses of existing geological data and Geological Report preparation
- Collection and analyses of existing hydrological data
- Analyses of present state of dam with appurtenant structures with engineering design
- Determination of general layout, optimization and engineering design of dam with appurtenant structures
- Implementation of Cost – Estimate with construction time schedule
- Economical and Financial analyses and Feasibility Study preparation

PIVA HYDROELECTRIC PROJECT

Location:	The Piva River, Montenegro
ployer:	Electricity Authority of Montenegro
Commencement date:	April, 1970.
Completion date:	November, 1975.
Contract Value:	M $ 7.5
Services provided:	Pre-Feasibility Study Feasibility study Investigation Field and Laboratory Works and Report Final and Detail Design Tender Documents Supervising during Construction As-Built Drawings

Reservoir

Total storage capacity:	880 x 10^6 m^3

Dam

Type:	Arch dam
Height:	220 m
Crest length:	268 m
Volume of concrete:	742 000 m^3

Spillway

Type:	Overflowing dam section-controlled spillway
Capacity:	1760 m^3/sec

Bottom outlets

at elev. 503	2 ∅ 2.25 m, capacity 240 m^3/s
at elev. 594.75	3 ∅ 2.50 m, capacity 373 m^3/s

Tunnels

Three headrace tunnels	∅ 5.00 lengths: 86.58 m 104.63 m 122.60 m
Three penstock (inclined at 45⁰)	∅ 4 m length: 138.65 m
Surge tank (cross section elliptical 20.50/11.00 m)	height: 29.60 m
Tailrace tunnel B=H=10.7 m	length: 112.82 m

Power House

Type:	underground
Turbines:	3 Francis (vertical)
Maximum head:	182 m
Installed capacity:	3 x 120 MW
Average annual power:	860 GWh

REDUCTION OF TAILWATER OF HPP PIVA

Contract title:	**FINAL DESIGN OF REDUCTION OF TAILWATER OF HPP PIVA FOR THE PURPOSE OF INCREASING PRODUCTION OF HPP**
Location/River:	Piva River / downstream from HPP "Piva" MONTENEGRO
Employer:	"Elektroprivreda Crne Gore" A.D. Niksic MONTENEGRO
Commencement date:	August 2008.
Completion date:	December 2008.
Contract price:	60,000.00 EUR
Investments cost:	1,600,000.00 EUR

Hidrological data

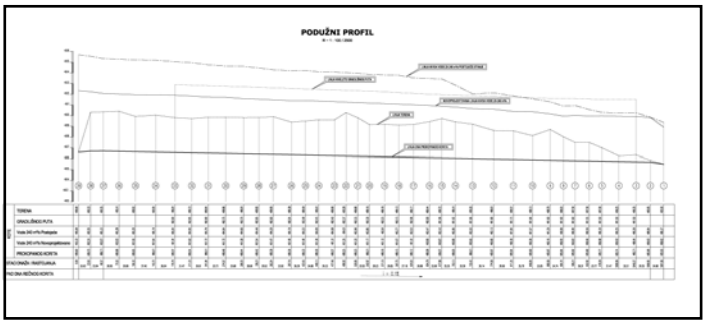
Total reservoir volume	880 x 10^6 m^3
Useful reservoir volume	790 x 10^6 m^3

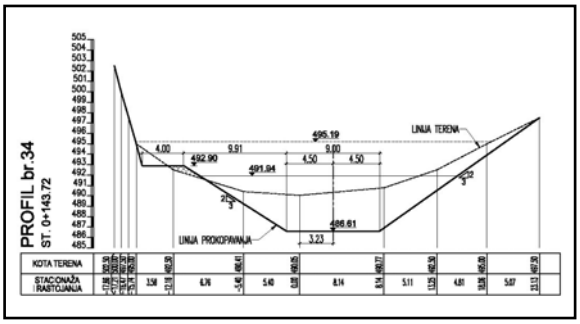
Dam-Water intake

Type	Concrete arch
Height	220 m
Dam length in crest	268 m
Arch length in riverbed	40 m

HPP

Max net-head	181.95 m
Min net-head	99.90 m
Installed discharge	3 x 80 m^3/s
Turbine	Francis, 3 pcs.
Installed capacity	360 MW





Description of the Project:

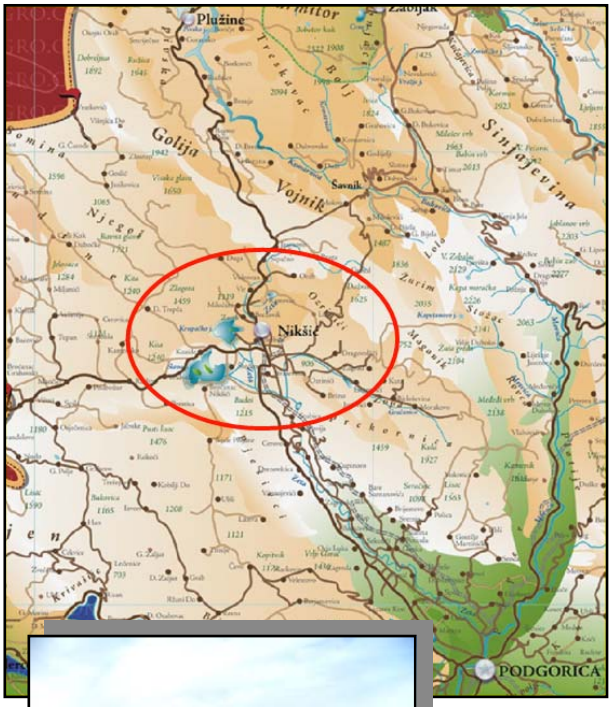
HPP station Piva is located in north-west part of Montenegro, in canyon part of the Piva River. HPP Piva is reservoir power-plant for production of electricity. Main purpose of riverbed excavation downstream from HPP Piva is reduction of tail-water of HPP, in order to increase the production of electricity.

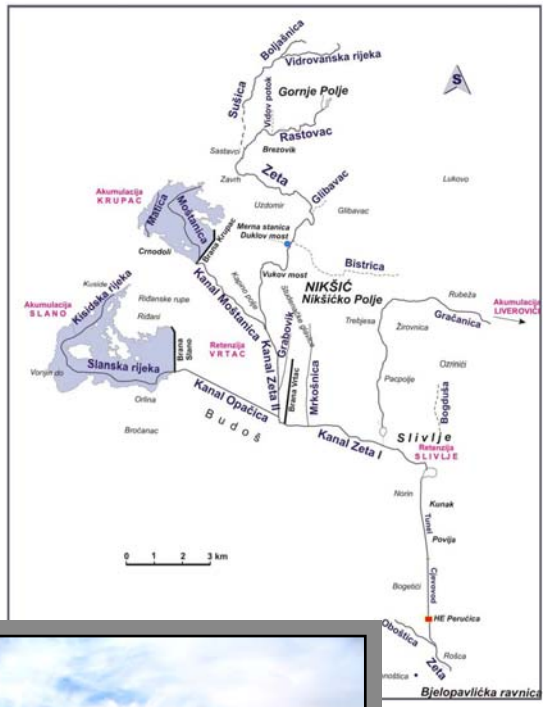
Excavation of riverbed downstream from HPP, caused changes of discharge curve, and reduction of power-plants tail-water level. With proposed activities bigger gross-head is provided on power-plant, and discharges is maintained on the same values, bigger net-head also. Consequences of increasing net-head are manifested with increase of energy and power, based on directly proportioning of energy and power with net-head and based on increase of turbines beneficial effects.
Regarding to Terms of Reference in Final Design is analyzed version with longitudinal head to new-designed riverbed 0.1%. Total length of new-designed riverbed is 1017.77 m. Cross-section of new-designed riverbed is trapezoid with riverbed width of 10 m and side slopes 1:1.5.
Development of work access road along new-designed riverbed is predicted.
Analysis of area and role, work system analysis and calculation of energy effects, that is realized with increase of production and power of HPP Piva, because of riverbed excavation downstream from power-plant, are based on actual and expected conditions of HPP MN system and basic energetic characteristics of HPP Piva, and within analysis production increment, power and seasonally possibility of water regulations in reservoir is considered.
As integral part of Final Design of reducing reservoir eater level HPP Piva, economically-financial analysis is performed. Economic analysis shows feasibility of a according social, macro population, or related to alternative thermo solutions. Financial analysis considered difference scenarios and their influences on the design profitability from standpoint of Employer, HPP MN.

The Services Provided:

- Review and systematization of existing documentations and data
- Topography investigations
- Engineering design (hydraulic, static, stability)
- Determination the optimal solution
- Preparation of energetic and economic feasibility study
- Preparation of construction management with bill of quantities
- Preparation of ecological studies – Environmental Impact Assessment Study
- Preparation of technical specifications with schedules.

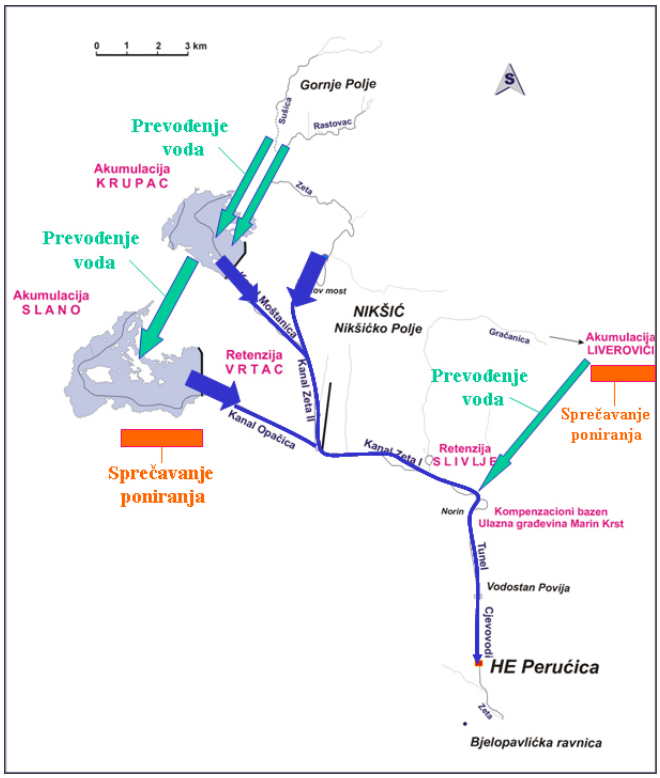
OPTIMIZATION OF HYDRO-ENERGETIC SYSTEM HPP “PERUCICA”

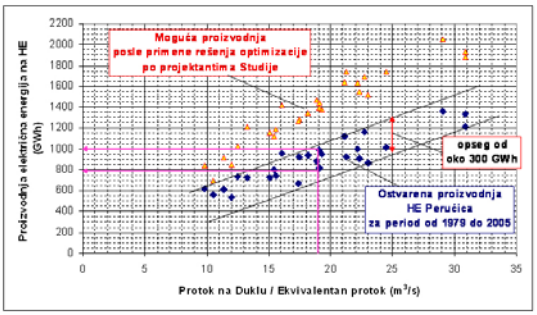




Contract title:	**REVIEW AND ENGINEERING EVALUATION OF TECHNICAL DOCUMENTATION-OPTIMIZATION OF HYDRO-ENERGETIC SYSTEM HPP “PERUCICA”**
Location:	Niksic field MONTENEGRO
Employer:	“Elektroprivreda Crne Gore” A.D. Niksic FC Proizvodnja MONTENEGRO
Commencement date:	2008.
Completion date:	2008.
Contract price:	40,000.00 EUR

Hydrological data	
Basin area	894 km^2
Mean annual discharge of water	34.8 m^3/s
Inlet organs	
Channel system	~40 km
Balancing reservoir	180,000 m^3
Pressure tunnel	3.323 m
Penstock	3 x 1900 m
HPP	
Gross-head	550 m
Turbine	Pelton, 8 pcs.
Installed discharge	8.5-12.75 m^3/s
Installed capacity	307 MW





Description of the Project:

HPP Perucica is combination reservoir-derivation system, constructed near Glava Zeta. Catchment area of hydro-geological basin of Niksic field is 894 km^2, while mean annual discharge of stream flow is 34.8 m^3/s. Installed capacity of HPP Perucica is 307 MW, while available is 285 MW.

HPP Perucica is contained from: reservoirs Krupac and Slano, retentions Vrtac and Slivije, systems of channels, stilling basin, balancing reservoir, approach channel with inlet structure, chamber Povija, three penstocks, power house with 8 aggregates, tail race channel, and switch board 110 and 220 kV.

As a result of studies of HPP system Gornja Zeta, HPP Perucica, technical documentation of ENOP is prepared ("Drustvo za energetske optimizacije" d.o.o. Podgorica), named "Optimization of hydro-energetic system HPP Perucica- system study with general design of structures".

The objective of a reviewing of Technical documentation was checking the feasibility of the technical solution, verification of influence of proposed variant on hydro-energetic system HPP Perucica, its existing production of electricity and total water potential of the environment, verification of total energetic effects and environmental impact assessment.

The Services Provided:

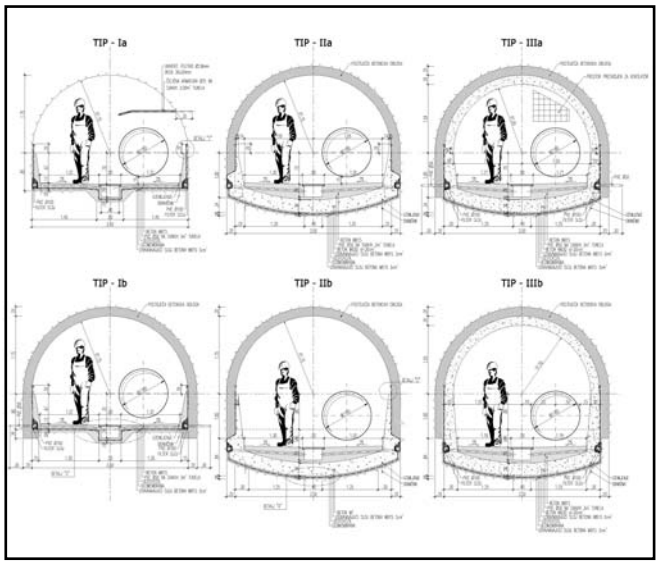
- Review and systematization of existing technical documentations and data
- Evaluation of present state
- Verification and evaluation of Technical documentation

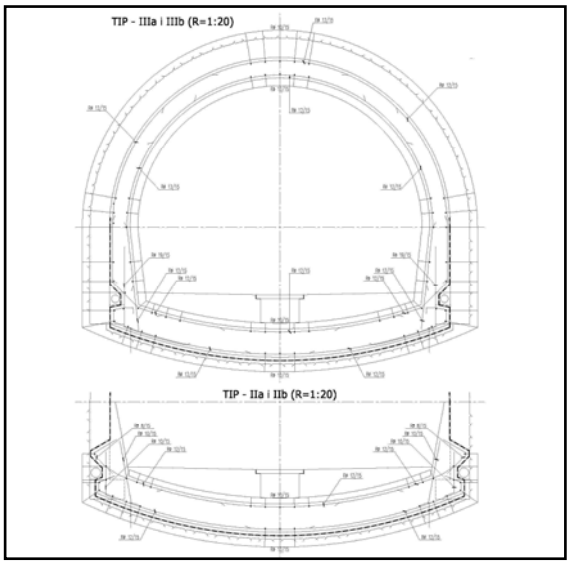
RECONSTRUCTION OF A HYDRO-TECHNICAL TUNNEL "SOZINA"

Contract title:	**FINAL DESIGN OF RECONSTRUCTION OF HYDRO-TECHNICAL TUNNEL "SOZINA"**
Location:	Territory of Bar municipality MONTENEGRO
Employer:	PC."Regionalni vodovod Crnogorsko primorje" Budva MONTENEGRO
Commencement date:	November 2007.
Completion date:	January 2008.
Contract price:	27,000.00 EUR
Investments cost:	2,300,000.00 EUR

Tunnel

Type	Hydro-technical (auxiliary to traffic tunnel)
Diameter	3.50 m
Length	4,200 m





Description of the Project:

Hydro-technical tunnel Sozina is located near to traffic tunnel Sozina on Bar municipality territory. North portal (entrance) is in area of a village Gluhi Do (Rijeljici), while the south portal (exit) is located in the area of a village Djurmani. It is constructed in order to provide regional water supply system pipeline crossing through hill Sozina, length 4188.09 m. Present conditions of water tunnel Sozina do not satisfy requirements for placement of regional system pipe for water-supply, while the purpose of evacuation from traffic tunnel is temporary provided.

The main purpose of technical documentation is design of reconstruction project and rehabilitation for the functions of water tunnel Sozina (placement of regional water-supply pipe and evaluation from traffic tunnel).

In Final Design, certain qualification is performed for estimation and comparison of present tunnel state and designed and investigative geology-geomechanics parameters. Lining calculation is performed for determination of necessary measures, for adopting possible additional influences from expansion and earthquake. Generally, three types of rehabilitation are adopted, and their schedule and representation are showed thru their belongings on sections along tunnel axis.

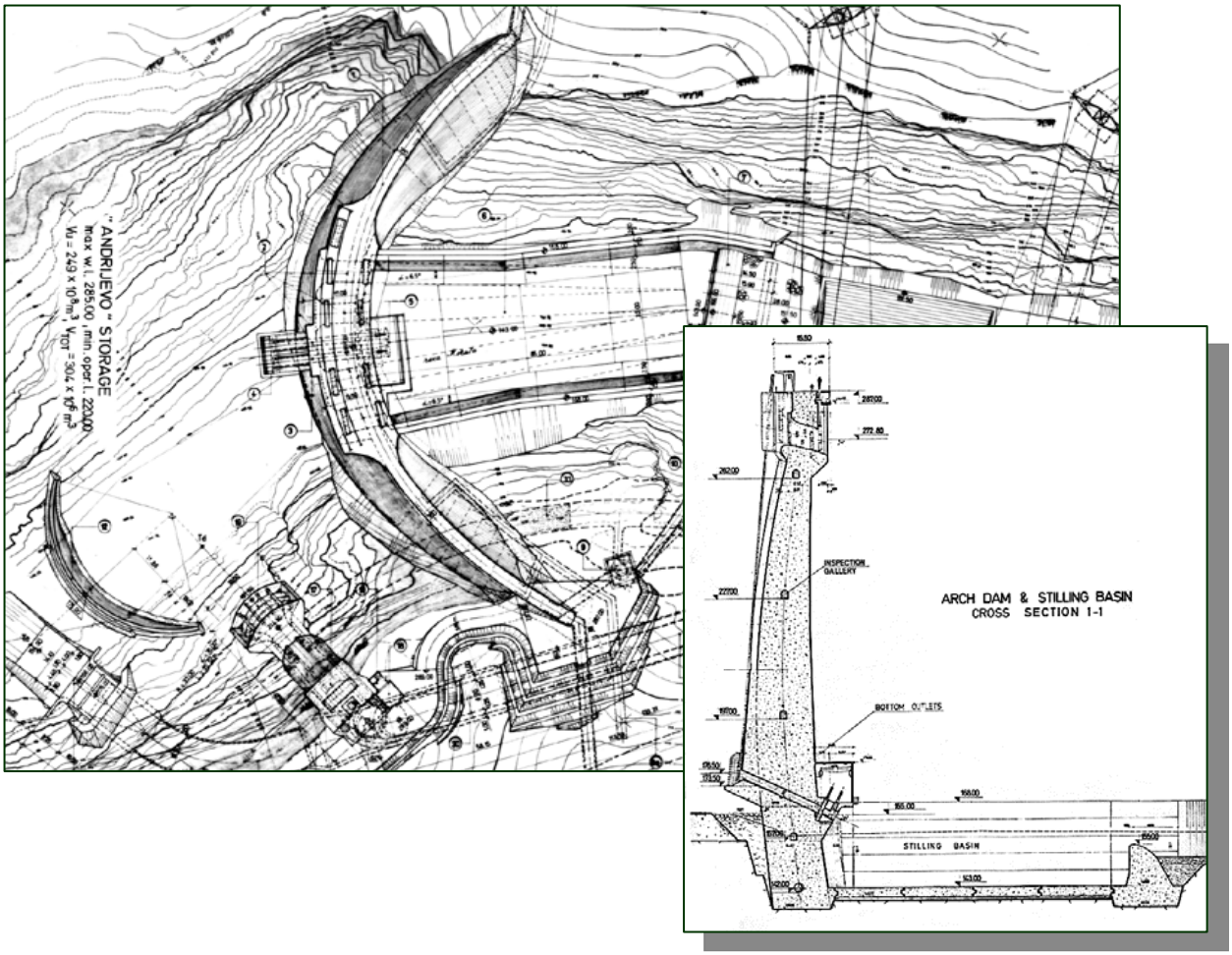
Also rock-water drainage with system of longitudinal and transverse drainage pipe, and main drainage channel in the middle of base vault is assumed.

Within electro-mechanical part of design, and design management, solutions related to tunnel lighting, ventilation, earthing, power supply and automatic control are presented.

The Services Provided:

- Review and systematization of existing documentations and data
- Preparation of geological study
- Engineering design (hydraulic, static, stability)
- Implementation of cost estimate with construction time schedule
- Preparation of environmental impact assessment study
- Preparation of technical specifications with schedules
- Fire protection design study

ANDRIJEVO DAM PROJECT

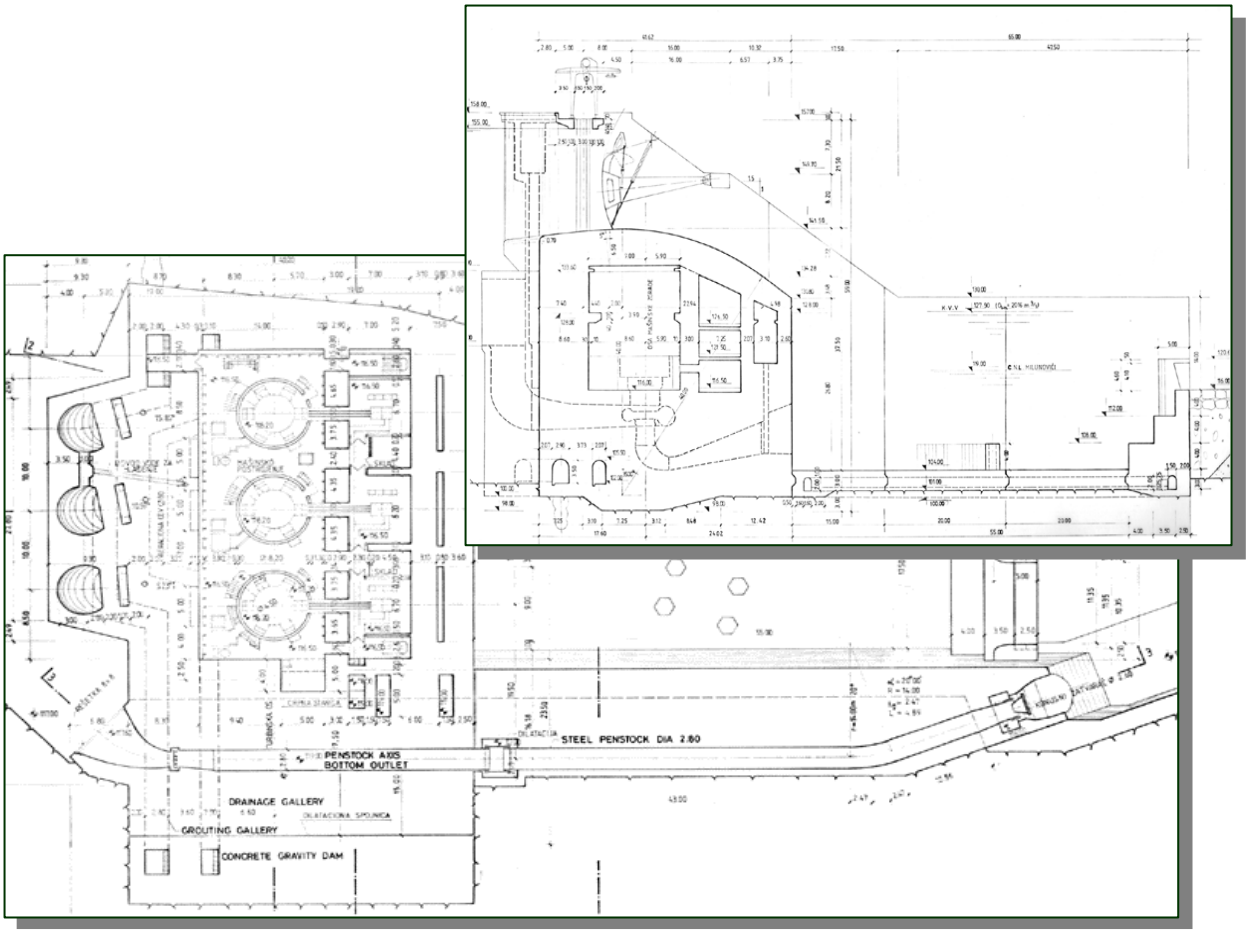


Location:	The Moraca River
Employer:	Electricity Authority of Montenegro
Commencement date:	1986. Design
Completion date:	1991. Design
Contract price:	M $ 5 (for Design)
Services provided:	Basic design Investigation Works Feasibility study Final design

<u>Dam</u>	
Type:	Arch dam
Height:	150 m
Concrete vol.:	360,100 m^3
<u>Power plant</u>	
Turbines:	3
Installed capacity:	195 MW
<u>Spillway</u>	
Capacity:	2.05 m^3/s
Type	Overflowing dam
<u>Tunnels</u>	
Length:	300 m
Diameter:	10.50 m

Description of the Project: Main purposes of Andrijevo Dam Project are power generation flood control, irrigation and water supply. System is composed of the following structures: arch dam, overflowing dam spillway, intake structure and power house.

RASLOVICI DAM PROJECT



Location:	The Moraca River
Employer:	Electricity Authority of Montenegro
Commencement date:	1986. (Design)
Completion date:	1991. (Design)
Contract price:	M $ 1.5
Services provided:	Investigation works Basic design Feasibility study Final design

Dam

Type:	Gravity dam
Height:	60 m
Concrete vol.:	160 100 m^3

Power plant

Turbines:	3
Installed capacity:	55.5 MW

Spillway

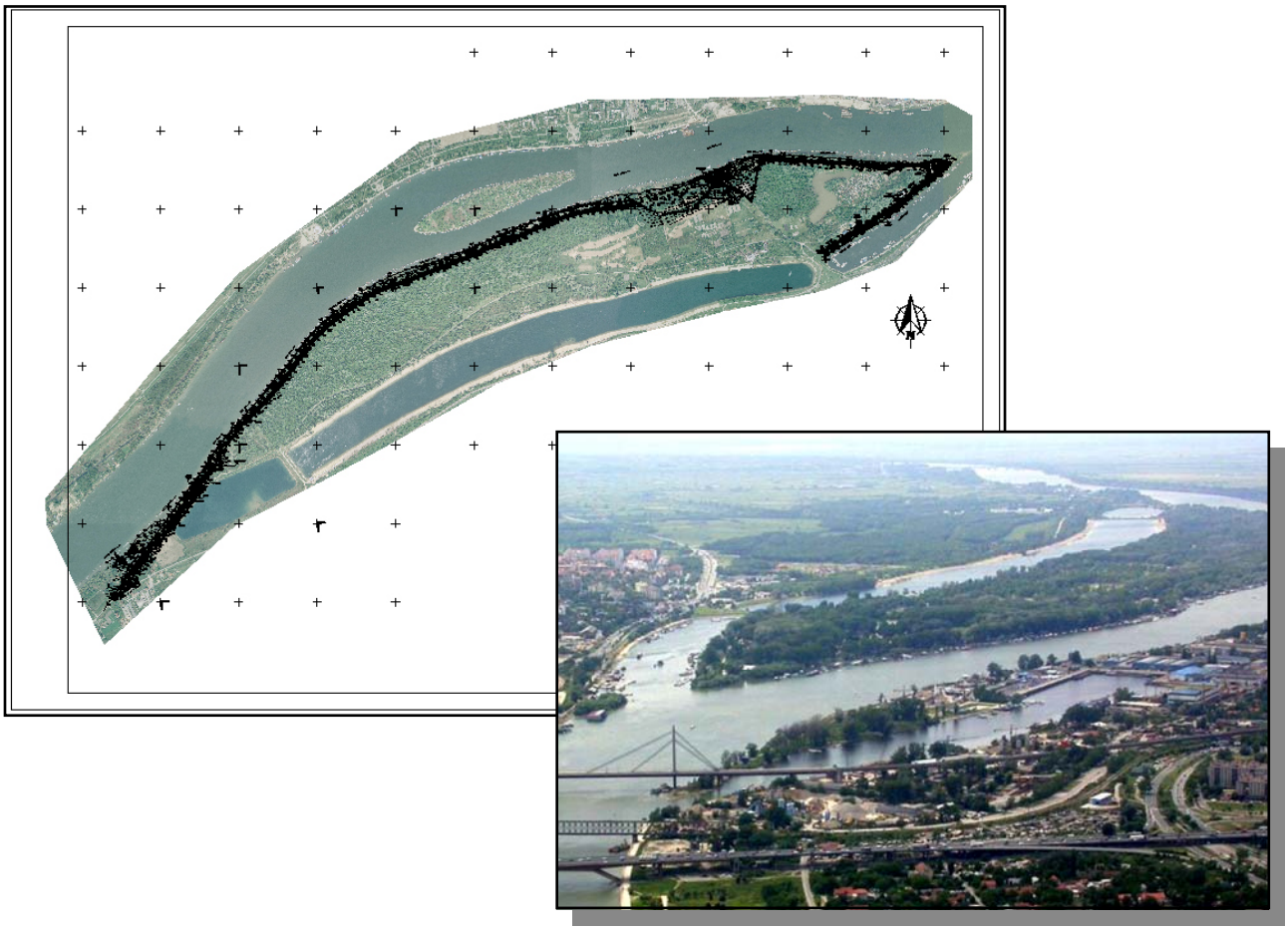
Capacity:	2 561 m^3/s
Type:	Spillway with 2 radial gates

Tunnels

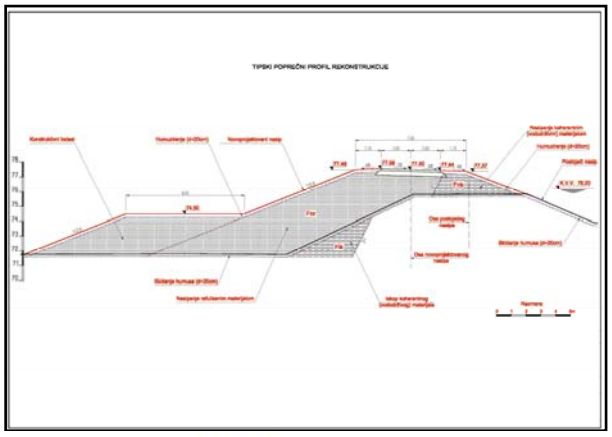
Length:	211 m
Diameter:	7.30 m

Description of the Project: Main purposes of Raslovici Dam Project are power generation flood control and irrigation. System is composed of the following structures: gravity dam, spillway, bottom outlet, intake structure with power house.

DESIGN OF LEVEE RECONSTRUCTION ALONG ADA CIGANLIJA



Contract title:	PLANNING REPORT AND FINAL DESIGN OF LEVEE RECONSTRUCTION ALONG ADA CIGANLIJA
Location/River:	Ada Ciganlija / Sava River - Serbia
Employer:	"SRBIJAVODE" -Water Authority, Belgrade
Commencement date:	2005.
Completion date:	2006.
Contract price:	11,500 €
Investments cost:	5,076,000 €



Description of the Project:

Ada Ciganlija is one of Belgrade's favorable recreational area. Flood protection of this 280 ha is managed by 7.3 km long earth-levee system (constructed in period 1961 to 1968). The existing levees do not give an adequate level of protection, so enlargement of the levees was a necessary issue.

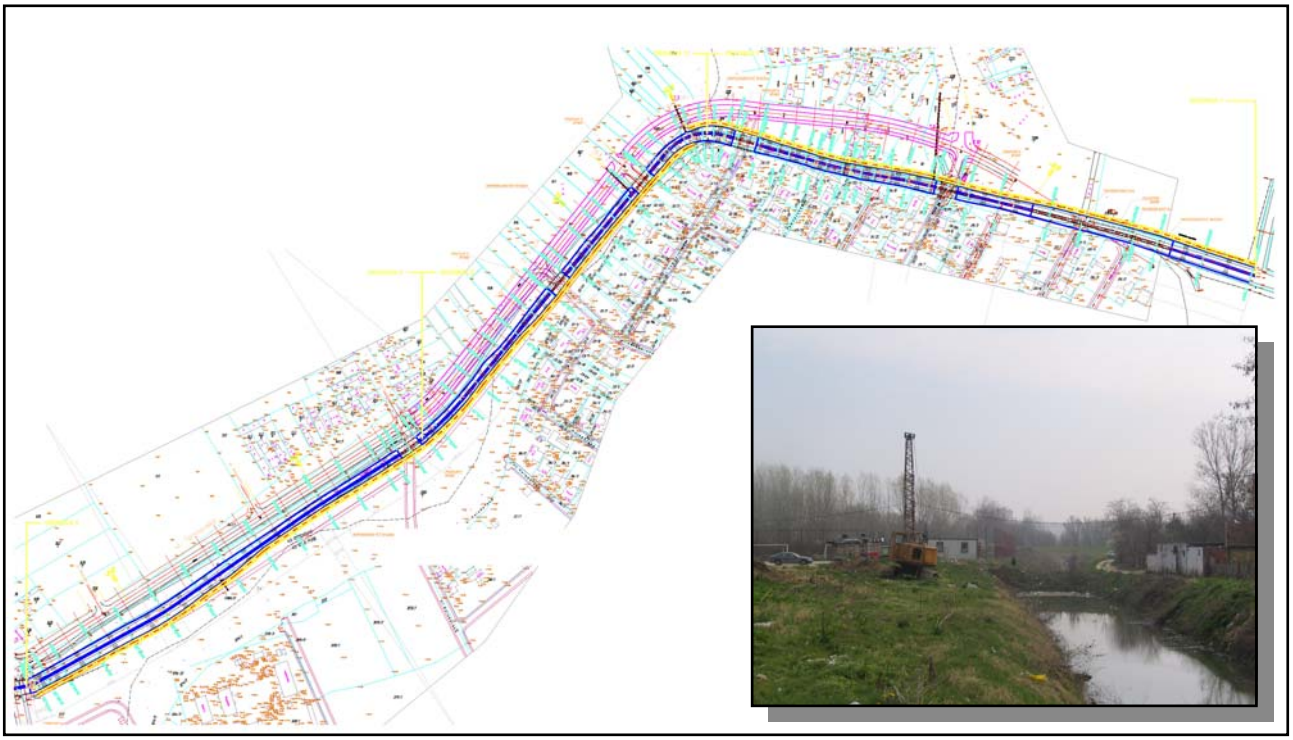
A landside levee enlargement which includes increase of levee section at the crown and landside of the levee was proposed in this project. A combined levee cross section with clay zone at the riverside and refilled sand at the landside of the levee is designed, except is some short sections where complete levee body is design of cohesive material. A seepage berm is designed at the landside for control of under-seepage problems in foundations beneath levee. Appropriate special design solution was given for the levee reconstruction at all locations with objects in the vicinity of levee (Renni-wells, pipeline crossings with the levee, objects of the rowing clubs, etc)

Increase of the levee crown is from 1.3 to 1.5 m, which leads to average reconstructed levee height of 5 m. Levee width in its crown is 7.5 m. The freeboard is in the range from 1.2 to 1.3 m. A designed levee solution guaranty protection of Ada Ciganlija from floods of return period of 1 in 100 years.

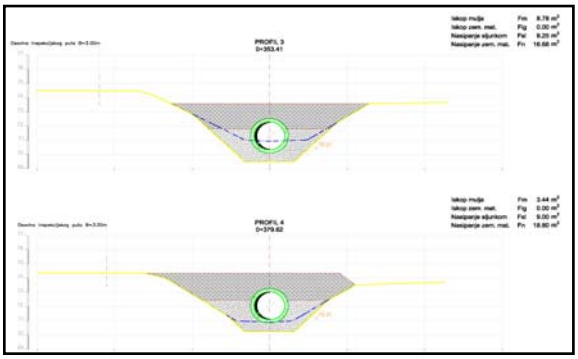
The Services Provided:

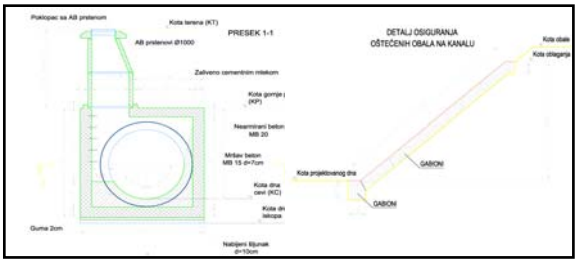
- Systematization of the available documentation and data
- Determination of levee reconstruction alternative solutions
- Engineering calculations (statical and filtration stability of levee)
- Investigation of property ownership in the zone of reconstruction
- Recommendation of optimum alternative
- Recommendation of phases in work realization

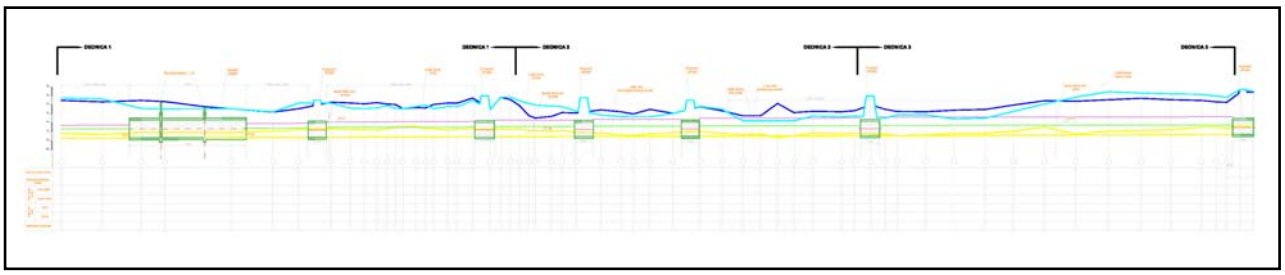
DESIGN OF REGULATION AND RELOCATION OF CHANNEL STARA TAMNAVA IN OBRENOVAC



Contract title:	PLANNING REPORT AND FINAL DESIGN OF REGULATION AND RELOCATION OF CHANNEL STARA TAMNAVA IN OBRENOVAC
Location/River:	Obrenovac / Stara Tamnava -SERBIA
Employer:	"SRBIJAVODE" Water Authority, Belgrade
Commencement date:	2006
Completion date:	2006
Contract price:	11,000 €
Investments cost:	404,200 €







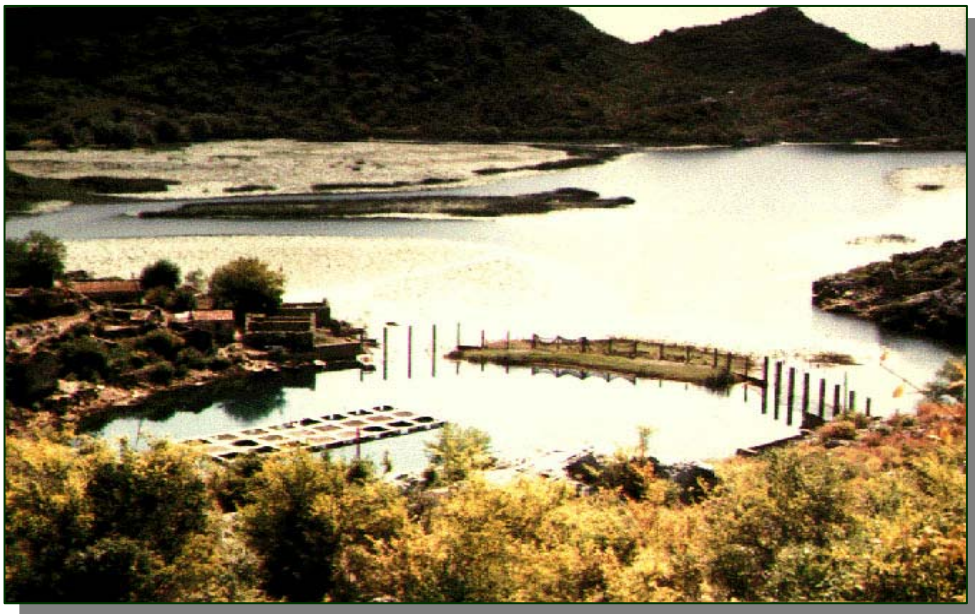
Description of the Project: Channel Stara Tamnava is one of the three main channels situated in the area of Obrenovac municipality. It collects water from the irrigation area upstream of Obrenovac as well as storm waters in the city and conveys them to the pump station Zabreske Livade, which pump this water to Kolubara river. Due to the fast urbanization of the town, one of the main city roads is planned to be constructed in the zone of the channel corridor. Relocation and regulation of the channel in the length of 1.4 km was the main issue.

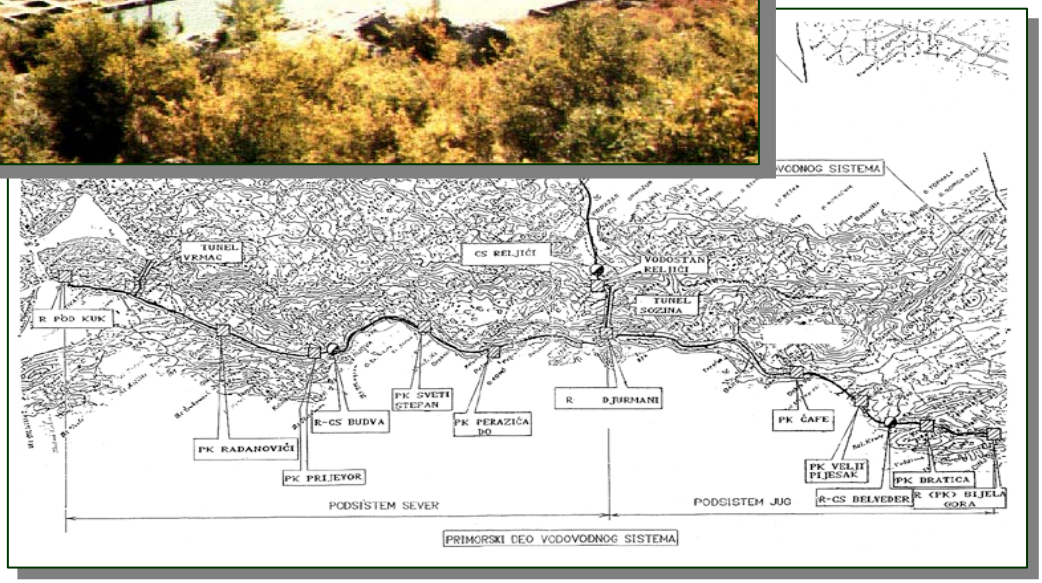
New channel corridor was proposed and designed for the required channel sector (bottom width 1.5 m with channel slope 1:1.5). In one part, channel was replaced with a concrete conduit 150 m long, 2 m inner diameter. At the locations of planned or existing street crossings with channel, six culverts (1600 mm inner diameter) were designed. All necessary hydraulic calculations of channel flow with culverts were performed with software Hec-Ras. Stability and structural analyses are performed, too.

The Services Provided:

- Systematization of the present data from technical documentation
- Engineering calculations (statical and hydraulic)
- Determination of optimal channel and culverts dimensions
- Definition of flood zones
- Detailed prescription of technology of reconstruction
- Determination of phases of work realization

REGIONAL WATER SUPPLY SYSTEM MONTENEGRO - pipeline

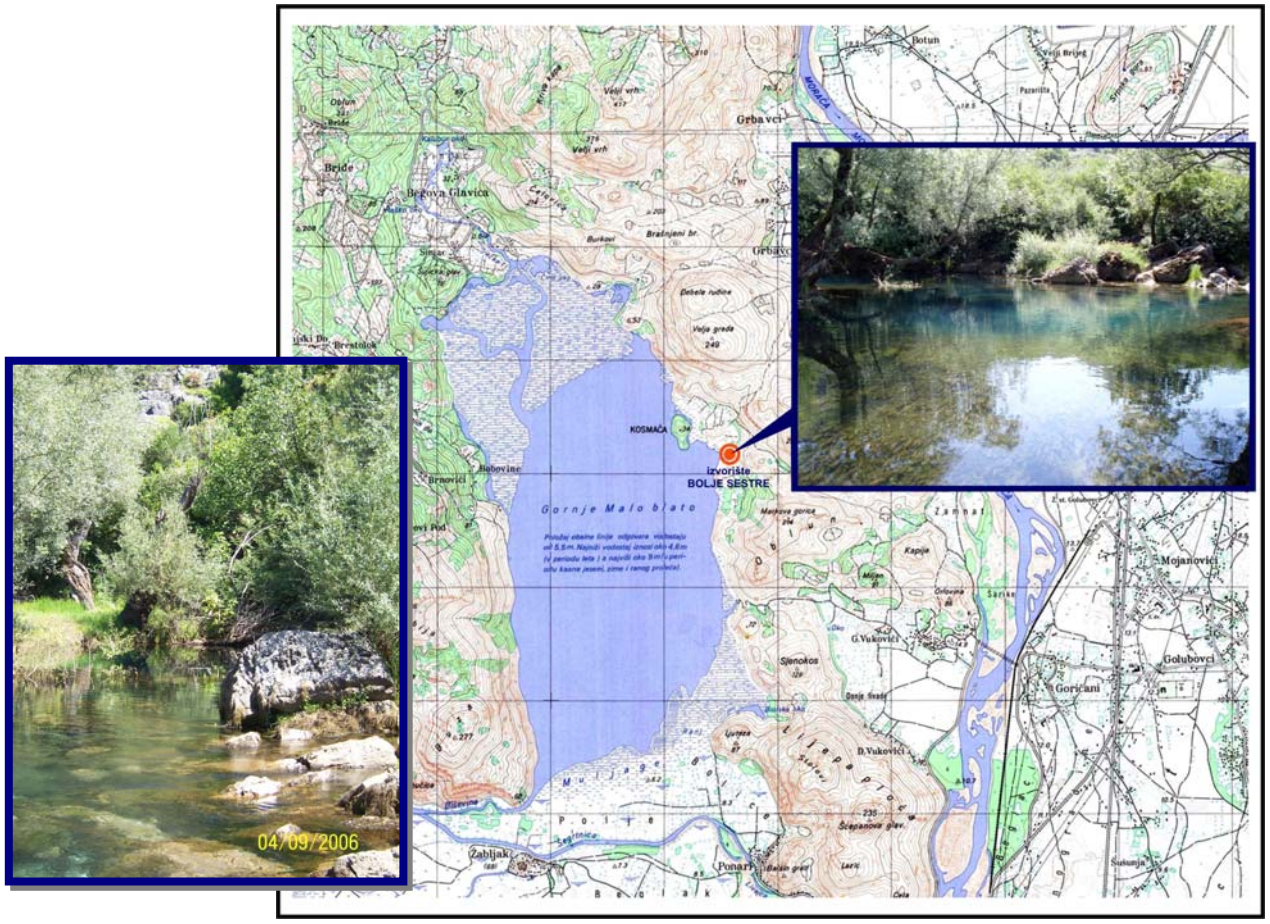




Location:	Montenegro	Pipeline	
		Type	Steel
		Length km:	140
Employer:	Authority of Montenegro	Diameter m:	1.10/0.80/0.40
Commencement date:	1995. Design		
Completion date:	1996. Design		
Contract price:	M $ 1		
Services provided:	Investigation works Basic design Feasibility study Final design		

Description of the Project: Regional water supply system is located on the South Adriatic Montenegro. Part of the pipeline completely submerged and founded on muddy lake bottom with very low bearing capacity.

WATER INTAKE "BOLJE SESTRE"



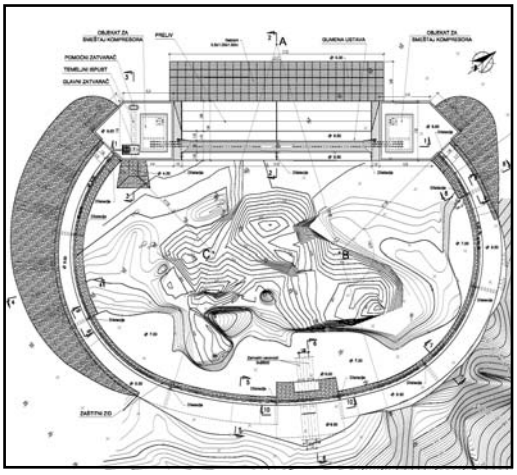
Contract title:	**FINAL DESIGN OF WATERINTAKE, TREATMENT PLANT AND PUMPED STATIONS ON WATERSOURSE OF WATERSUPPLY REGIONAL SYSTEM OF WATERSIDE PART OF REPUBLIC MONTENEGRO**
Location:	North-west part of Skadarsko lake, MONTENEGRO
Employer:	J.P."Regionalni vodovod Crnogorsko primorje" Budva, MONTENEGRO
Commencement date:	2007.
Completion date:	2008.
Contract price:	35,000.00 EUR
Investments cost:	950,000.00 EUR

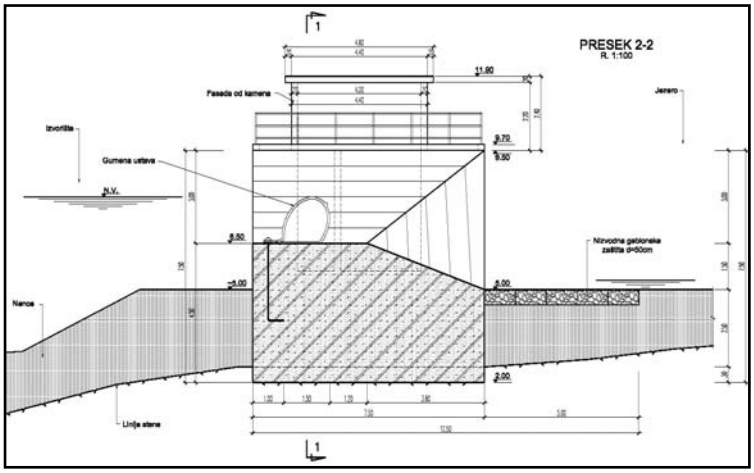
Hydrological data

Reservoir area	300 m^2
Hydrological minimum	2.0 m^3/s

Dam-Water intake

Type	Gravity dam with rubber water gate
Spillway height	4.5 m
Spillway crest length	24.0 m
Wall height	5-7 m
Wall length	102 m





Description of the Project:

Reservoir Bolje Sestre is located on northwest edge of Skadar lake, in a bottom of western slopes Kolozuba, near Kosmac island, in the area of Malo Blato basin. By many parameters (productivity, quality etc.) this reservoir is adopted as the most appropriate location for water interception, in order to satisfy demands of Regional Water Supply System, for Montenegro coast.

Reservoir comprise around 300 m^2 area. On this area it is located more water sources, that point out underwaters, from stratified limestones, mostly in central part, with level field at the bottom of 2.5 mm - 4.5 mm. Estimated water, inflow in hydraulic minimum is from 2.0 m^3/s.

In order to protect this source area from directly influences of Skadasko lake waters, and achieving much better quality of affected waters, this project proposes construction of water intake structures in ellipsis concrete constructions shape- dams with rubber water gate and dams with protective concrete wall around water source area.

Concrete dam as a sill, length 24 m, height 4.5 m, is used as a footage for rubber gate and together with it presents spillway part of protective construction of water source area.

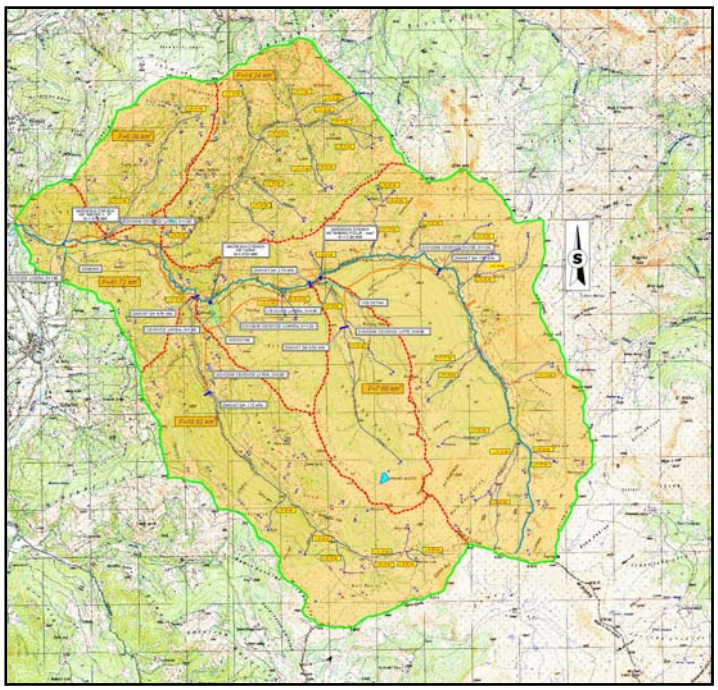
Spillway is outlined on both sides with massive concrete blocks that connects spillway and concrete wall in background. On the concrete abutments, objects for rubber gate manipulation equipment placing are predicted, while the bottom outlet is located at the concrete block on the left side of spillway.

Length of a concrete wall in background is around 102 m, wall width in crest is 60 cm, while the height is 5.1 m - 7.0 m. Inside wall edge (to source area) is rounded in a circle shape, and performed with displacer in face side. Inside wall crest edge follows ellipsis shape. Outer edge (on background) is vertical. On east side of analyzed construction in protective wall, two openings for pipelines are foreseen, which convey water from water source area to pump station.

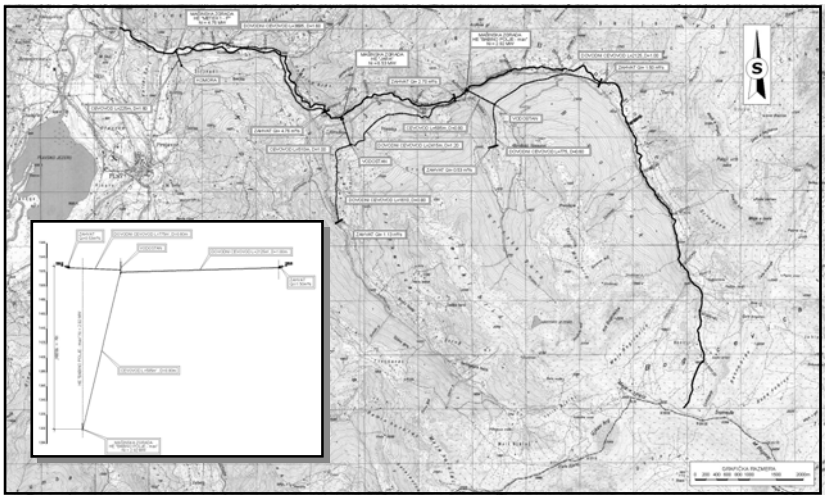
The Services Provided:

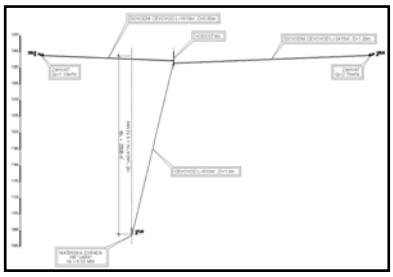
- Review and systematization of existing documentations and data
- Geo-site investigations and following study
- Engineering design (hydraulic, static, stability)
- Implementation of cost-estimates.

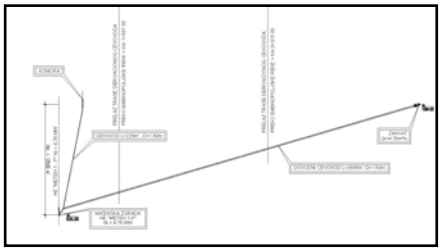
PRE-FEASIBILITY STUDY OF HYDRO-ENERGETIC WATER UTILITIES OF BABINOPOLJSKA RIVER



Contract title:	**PRE-FEASIBILITY STUDY OF HYDRO-ENERGETIC WATER UTILITIES OF BABINOPOLJSKA RIVER**
Location/River:	Plav / Babinopoljska River MONTENEGRO
Employer:	"KRONOR" Ltd. Podgorica MONTENEGRO
Commencement date:	2008.
Completion date:	2009.
Contract price:	120.000 EUR
Investments cost:	14.000.000 EUR







Description of the Project:

Pre-feasibility study of hydro energetic development of Babinopoljska River, thoroughly analyzed lot of different possible conceptions of water utilities. Based on available surveys, technical solutions for 15 different small hydro-power plant structures are proposed, in three basic concepts of exploitation, differently combined in 8 variants, i.e. exploiting hydro potential system. Techno-economic analysis and multi criteria analysis, that considers ecological and social effects generated by these structures construction influences of building these objects, are performed. Analysis and calculations are prepared for all objects individually, and for the whole system. All results clearly shows that optimal solution for exploitation of hydro-potentional Babinopoljska River is system consisted of following small HPP: HPP Babino Polje, HPP Jara and HPP Meteh.

HPP Babino Polje is a derivate plant, with net head 173.5 m, installed capacity of 2.92 KW, and total annual power production 6.655 GWh/year. Water intakes on Babinopoljska and from Treskavicka River, are both of Tirol type. Diversion pipelines are steel.

HPP Jara is a derivate plant, with net head 198.5 m, installed capacity of 6.53 KW, and total annual power production 17.575 GWh/year. Water intakes on Babinopoljska and Treskavicka River, are both of Tirol type. Diversion pipelines are steel.

HPP Meteh is a derivate plant, and its proposed layout is by the road, installed capacity is 4.76 KW and total annual power production is 12.634 GWh/year. Water intake is predicted as a Tirol type intake, and pipelines in this case are steel.

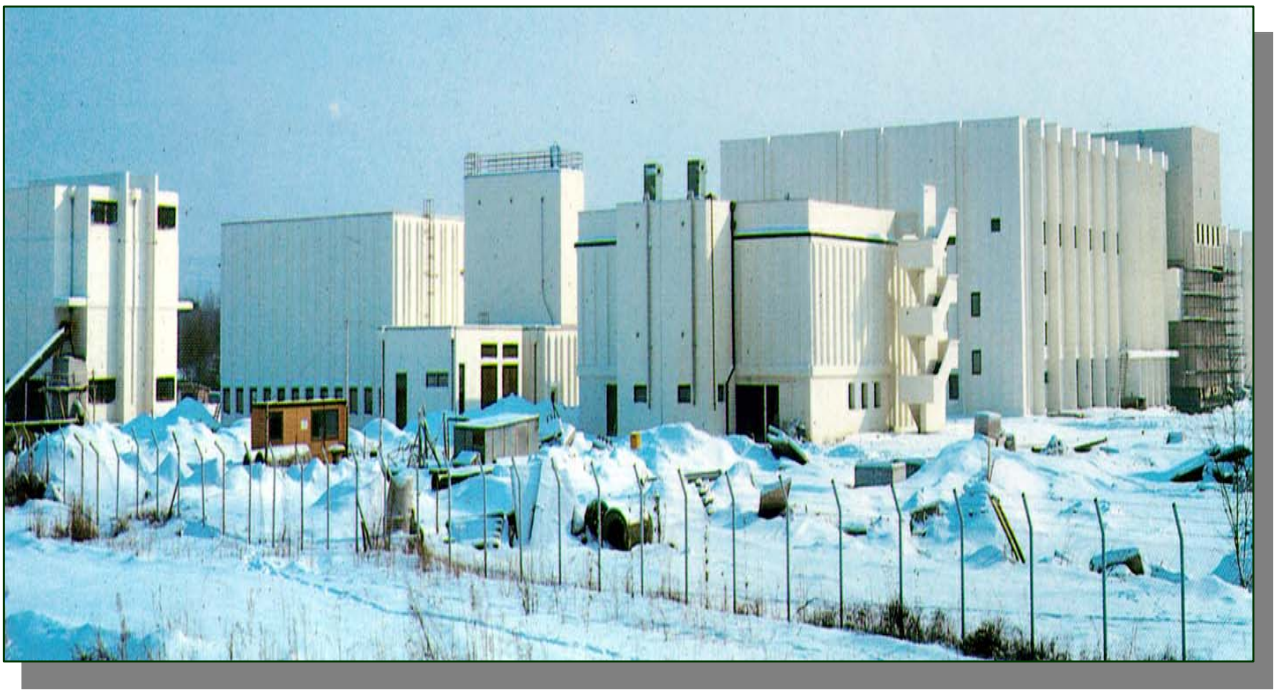
The Services Provided:

- Review of existing technical documentation
- Adoption of technical solution, presentation of variant solutions (hydro-civil part, hydro-mechanic and electrical-mechanical equipment) and investment values of considered solutions
- Preparation of energy study
- Preparation of environmental and sociological aspects studies
- Preparation of economic studies
- Techno-economic analysis
- Preparation of field investigations program for next phase

WASTE WATER TANKS

Location:	G.Milanovac, Lazarevac, Obrenovac	<u>Tanks</u>	
		Type:	Steel
		Diameter:	13.00 m
Employer:	Authority of Serbia	Height:	25.00 m
Commencement date:	1990.		
Completion date:	1994.		
Contract price:	200,000 EUR		
Services provided:	Basic design Feasibility study Final design Detailed design		

WATER TREATMENT PLANT MAKIS



Location:	Belgrade
Employer:	Water Authority of Serbia
Commencement date:	1984.
Completion date:	1987.
Contract price:	M $ 3 (for Design)
Services provided:	Investigation works Basic design Feasibility study Final design Detailed design

Water pumping station

Capacity: 8 pumps 3600 m^3/h
2 pumps 1800 m^3/h

Description of the Project: Treatment of the Sava River water for potable water supply of the city of Belgrade with capacity 3.200 l/s.